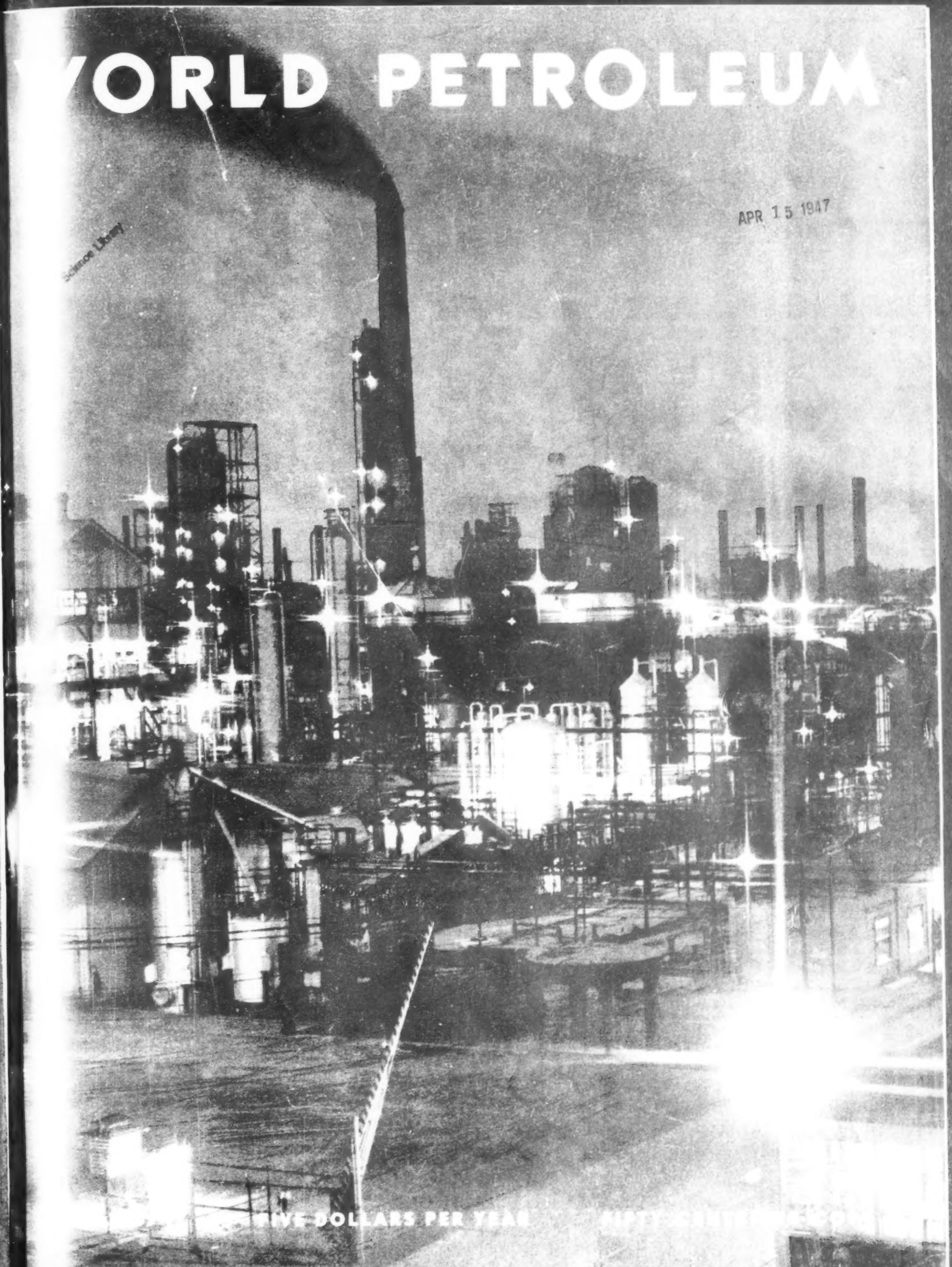
WORLD PETROLEUM

APR 15 1947



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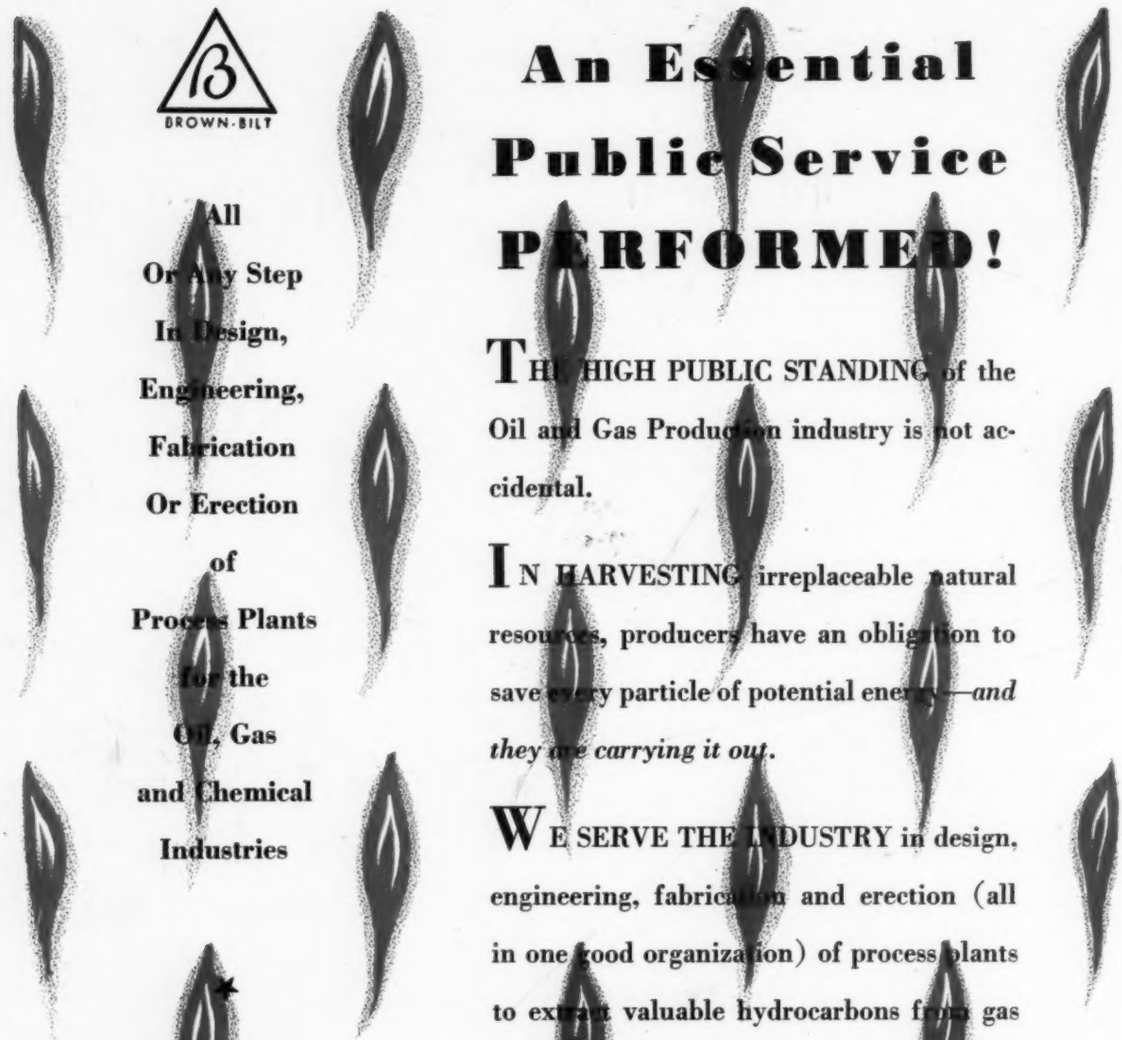

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This Month's Cover

This photograph of Shell Oil Company's Wood River, Ill. 90,000 barrel refinery recently was selected by U. S. Camera Magazine for publication in its Annual Review of outstanding industrial pictures.

1946 Annual Index

An index to all issues of WORLD PETROLEUM published in 1946 now is in course of preparation and will be ready for distribution to subscribers soon. Copies will be sent free of charge on request. Please address your card or letter to Editorial Department, WORLD PETROLEUM, 2 West 45th St., New York 19, N. Y.

Continental to build small TCC unit at Denver

THIRD SMALL TCC LICENSED SINCE WAR WILL BE FIRST CAT-CRACKER IN COLORADO

As an important part of a $4,000,000 construction program to enlarge its Denver refinery, Continental Oil Company has contracted to build a new small T C C unit of 3,300 B/D fresh feed capacity. Engineering and design of the new unit are already under way and its completion is scheduled for early 1948.

Although the new unit will be the first cat-cracker to be built in Colorado, it will be Continental's fourth T C C, three others of larger capacity having been operating since early 1944 in the company's Ponca City refinery. Improved features of design and construction, which will be incorporated in the new unit, will provide a higher yield of motor fuel than any single catalytic cracking unit in existence.

Houdry will be glad to furnish to any refiner, a complete economic analysis to show exactly what T C C can do for his particular operation.

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U. S. POLICY IN ITS RELATION TO OIL

PROMULGATION by President Truman in his address to Congress last month of a new, or at least a more forthright, policy by the United States in support of the right of all nations to free determination of their political and economic systems is recognized everywhere as bringing into sharp focus a question that has assumed growing importance with every passing month since the close of World War II. It puts clearly before the world a problem that had to be faced sooner or later and forces into daylight a menace to the establishment of a new world order that has been somberly discussed in private in official and diplomatic circles but that for the most part has been avoided in public utterances or exchanges between governments. It might have been easier to deal with the issue involved if it had been raised earlier, but to have ignored it longer obviously would store up future trouble so serious that it might well defy peaceful adjustment.

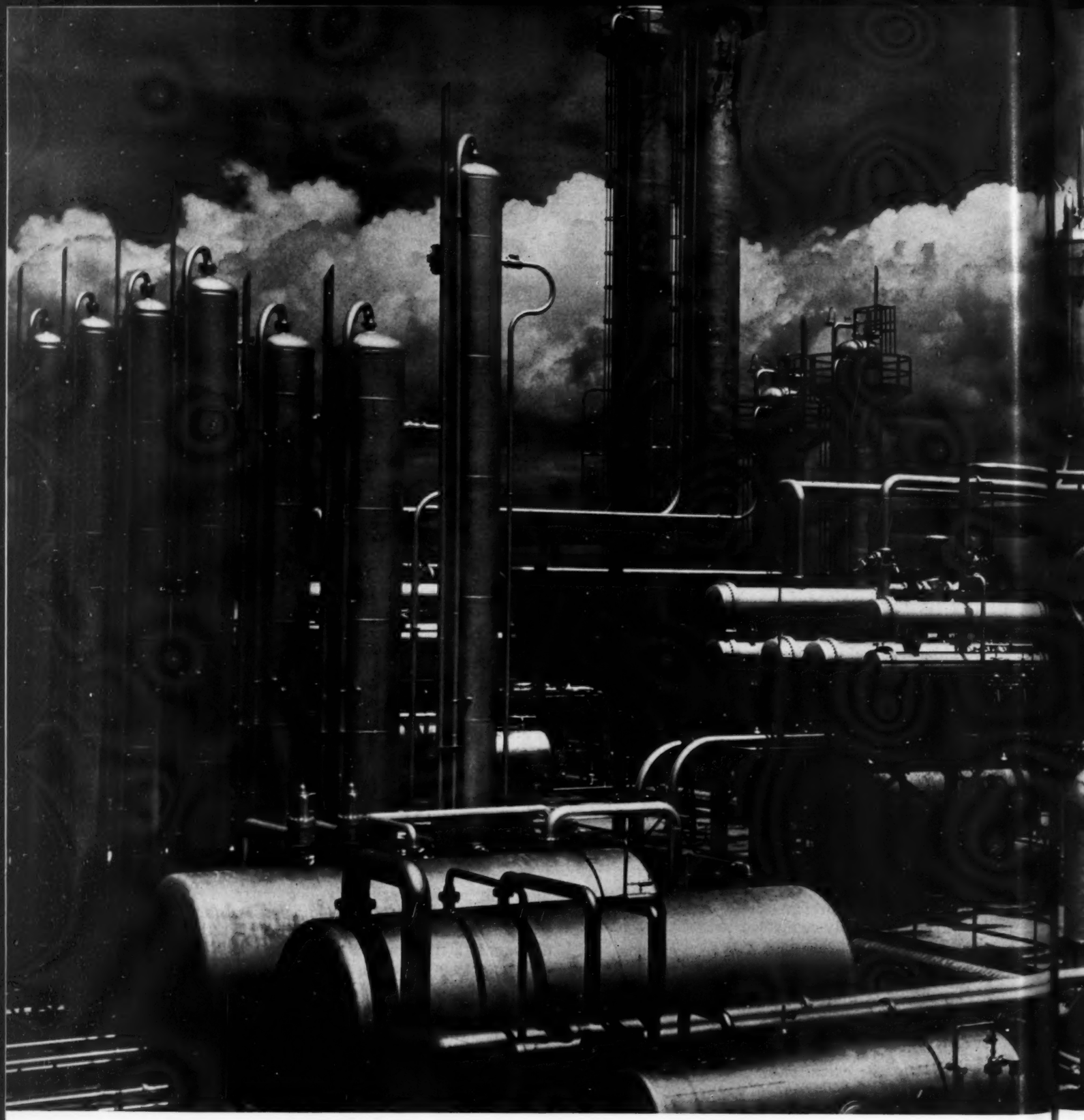
Fairly viewed, there is nothing in the President's statement that is incompatible with the effort to settle world problems by international agreement. It was in effect a reaffirmation of the promises of freedom contained in the Atlantic Charter and publicaly endorsed on numerous occasions by all the leading powers. It was not an attempt to undermine or nullify the United Nations but rather served to direct attention to conditions that threaten the fundamental principles of that association. It proposed unilateral action only to the extent of meeting a situation which that body is not equipped to cope with in the present state of its organization. Its purpose was ably confirmed by Secretary Marshall at Moscow in his definition of democracy as the term is understood by Americans and his reference to the part played by the suppression of individual rights in upbuilding the power of the anti-democratic Nazi regime in Germany.

If Congress gives its support to President Truman's proposal for the extension of moral and financial aid to Greece and Turkey, it unquestionably will establish a precedent for similar action elsewhere as conditions may require it. Other nations too weak to resist by force open or conspiratorial attacks upon their sovereignty are looking hopefully to Washington for its decision and undoubtedly will come foreward with claims to like consideration, if the recommended action is approved. The course proposed may prove to be a costly one for the United States but certainly less costly and destructive than another world involvement in war The policy should properly be weighed with full consideration as to whether it will lessen or contribute to that danger.

Nor can it be questioned that implementation of the President's policy will encounter many pitfalls. Its success will depend upon general recognition, even among those who deny it, that the United States has no ambition for territorial aggrandizement or for domination of any other nation. It is unfortunate in a way that the President's plan should have been labeled in many reports as a fight against communism. Neither the United States nor any other government has the right to object if the people of any country of their own free choice adopt communism or some other system. It is proper to insist that their freedom of choice shall be maintained and that their rights shall not be stifled or filched by open or clandestine enforcement of minority rule. It is the methods that have been employed and are now being attempted in some places by communist and facist groups alike that are open to attack. Statement of the principle is simple, but its application may be difficult where the conflicting claims of many rival groups have to be weighed.

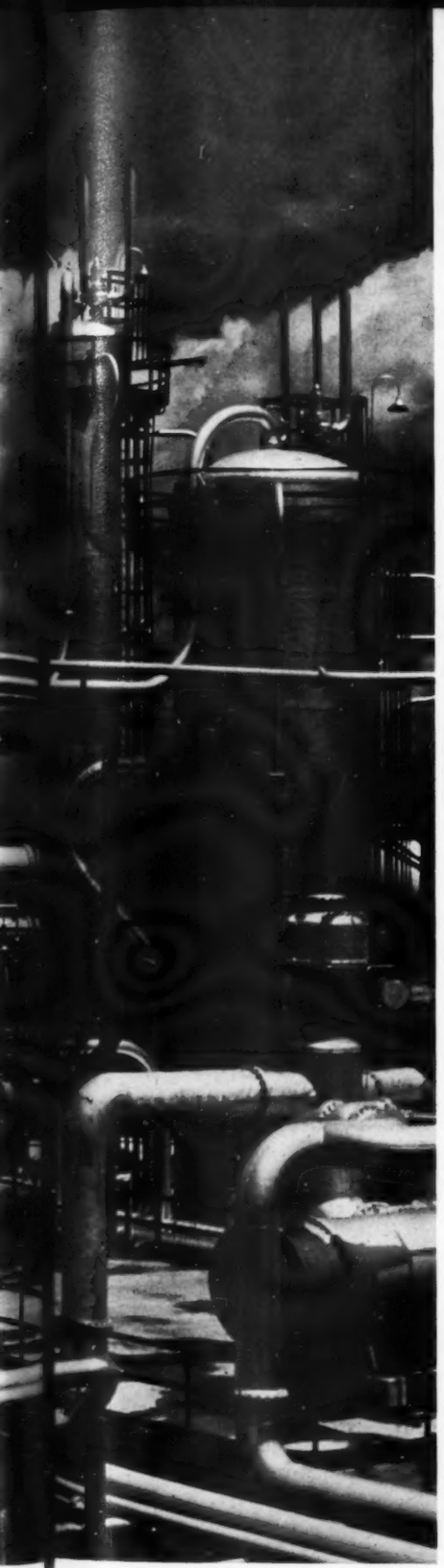
The policy advocated by the President has special significance for the international oil industry for two reasons. Ambition for the possession of oil resources has been one of the causes for the invasion or atempted domination of oil-producing countries in the past. Control of such large-scale resources is essential to realization of the ambitions of any aggresor, as was strikingly demonstrated in the recent war. Back in April 1939, it was forecast in these pages that if Hitler precipitated war, theNazi military strategy would be to overrun Romania and gain possession of its oil industry and then to make a drive across Russia for the fields of Grozny and Baku. The attempt was made, it failed by a narrow margin; otherwise Europe might today be ruled from Berchtesgaden.

If the United States is to lend its assistance to the maintenance of freedom and fair play and to the protection of small countries, it must insist even more vigorously than in the past upon preservation of the integrity of weak nations, including those that are important producers of oil, upon recognition of their privilege to decide their own political and economic systems, upon preservation of the historic American attitude, and its reassertion rights legitimately acquired and upon maintenance of an open door and equal opportunities. This is a threat only to those who would work evil in the world.



Abercrombie-Magnolia plant at Old Ocean, Texas. Photo by Harry Pennington, Jr., courtesy J. F. Pritchard & Co.

ECONOMIC ASPECTS OF CYCLING



By EMBY KAYE

CYCLING was first described in these pages in early 1939 as a means of producing condensate from so-called condensate fields of the southwest, without waste, and within the conservation regulations promulgated by the state regulatory bodies. When first brought to the attention of the oil industry in mid-1938, it was regarded with considerable interest but not without skepticism. The subject received local notice from trade associations in the southwest, but it was several years before cycling was recognized as a new, but sound production technique, destined to play an increasing role in the recovery of petroleum products from underground reservoirs.

In retrospect, there seems to have been nothing unique in this development, but the implications are significant when it is observed that prior to cycling, so-called condensate wells could not legally be produced unless there was a market for the stripped gas. As a matter of fact, there was scarcely any market with respect to most of the fields. As a result, only a handful of wells were produced while there were several scores of recognized condensate fields in various stages of development, but shut in for want of a producing mechanism.

Those who projected plants with the advent of cycling, had, in the main, more or less developed reservoirs, most of the wells of which were drilled before the real character of the reservoirs were known. The wells were exploratory and therefore were not located according to any particular pattern. The operator adopted the little known cycling technique as a means of recovering the investment already made in the drilling of the wells. Indeed, in many of the earlier situations, the well owner allowed others to construct and operate the plants for the processing of the gas for a stipulated share of the extracted products. In either case, he sought to utilize the wells already drilled and to develop with them the best well pattern possible which would indicate the maximum recovery of wet gas, which is tantamount to saying, with the least chance of contaminating the wet gas by injected dry gas. In some cases this required the drilling of additional wells, frequently for injection purposes, in order to place them more strategically for the purposes they were intended to serve. This was the experience in the very first plant at Cayuga, as well as at Stratton, Long Lake, Agua Dulce, Cotton Valley and in numerous other fields.

The very earliest conception of cycling contemplated the movement of a "wave of pressure" from the area of the input well or wells through which the dry gas was introduced into the reservoir, toward the producing well or wells and the purging of the wet gas by dry gas behind it. Strategically located wells to produce the wet gas would assure minimum dilution of the wet gas. Electrical models simulating the field were early employed to indicate the direction of flow by the displacement of wet gas by dry gas and to assist in the location of additional wells to be drilled. Where only a few wells had been drilled, it was possible to select the most ideal well pattern and to save large sums which otherwise were frequently spent for the drilling of what proved to be unnecessary wells.

The best illustration of an idea well pattern is the La Gloria project, located in Jim Wells County, Texas. Here, the five wells shown in the block (Figure 1) were the only wells drilled before the character of the reservoir fluid was recognized and cycling determined upon as a means of production. Study of the reservoir by geophysical surveys resulted in the use of these wells as injection wells and a series of new wells, to be used as producing wells, were equally spaced on the periphery of a circle around the original wells, the circle approximately outlining the indicated area of the reservoir. The project has been in operation for over six years and has been performing as forecast when it was engineered. A high recovery of the reservoir condensables is anticipated and should be realized.

The Cotton Valley field of Louisiana, one of the early and important condensate reservoirs is an example of a field which was over-developed before cycling was adopted as the production technique. Some 50 wells, later considered unnecessary, were drilled in this field. In spite of these, Cotton Valley is an outstanding example of engineering efficiency in the cycling field. The "unnecessary" wells have afforded the operators an excellent opportunity to follow the displacement of the wet reservoir gas by injected dry gas and to compare the anticipated shape of the dry gas encroachment pattern with the actual. The data obtained are of value not only to assist controls in this field but for the art in general. On the basis of observations five and one half years after the operation of this project was started, project engineers have been able to conclude that they will produce 85-90 percent of the wet gas from the reservoir. That is not to say that this percentage of the condensates in place when the project was started will be produced. Tests over the years have shown a diminution of liquid content of the reservoir gas due to liquefaction in the reservoir as a result of the drop in pressure owing to the withdrawal of a larger volume of reservoir fluids than is returned in the form of dry gas to the reservoir. This tendency was observed over a considerable period before cycling when the condensate was recovered in traps or separators and the gas marketed; it was one of the compelling reasons for resorting to cycling as a more efficient production practice. Cycling retarded the rate of decline of reservoir pressure. The gross effect of the arrestation of pressure decline by cycling and the better recovery of liquids from the produced gas may be read in these figures: a recovery of 8,000 bbls. (from one sand) per pound pressure drop before cycling as against 50,000 barrels per pound after cycling was instituted.

It is interesting to observe the ultimate condensate production per well in some of the cycling projects. Based upon the recovery factor referred to in the preceding paragraph, the engineers associated with the Cotton Valley project have estimated that the condensate from one sand (Bodcaw) over the life of the field will average 357,000 bbls. per well, including all the wells drilled. If no excess wells had been drilled, this figure would have been on the order of 700,000 bbls. The high liquid content of the gas is, of course, responsible for the relatively high output per well. The average content of liquefiable components is of the order of 25 bbls. per million cubic feet of gas while Cotton Valley gas contained 75-80 barrels per million.

It was early recognized that the efficient cycling of gas would be improved by unitization. Voluntary unitization, with the approval of the regulatory bodies, offers in most cases the most efficient control of development. It makes possible the development of a field with the drilling of the least number of wells. It affords better planning to obtain maximum drainage efficiency since all information obtained from the drilling of the earliest wells is available to the "planners" and makes possible the laying out of a well pattern without regard to property lines. Considerable manpower can be saved by operating the properties as a unit.

One of the latest cycling projects where unitization was effected early in the life of the field gives promise of a development of high efficiency from the standpoint of maximum wet gas recovery from the reservoir and the ultimate production of liquids per well drilled. The Benton Unit in Boissier Parish, Louisiana, encompasses some 10,000 acres and has a total of 15 wells drilled or planned. If the present number of wells is not increased, the ultimate recovery of 15 million barrels of condensate will represent a million barrels per well, including not only the

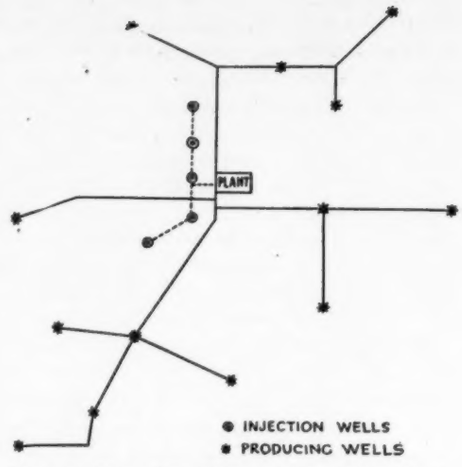


Figure 1. Map of La Gloria field, Jim Wells County, Texas.

wells used to inject the dry gas to the reservoir, but also the two dry holes drilled to determine the productive limits of the field.

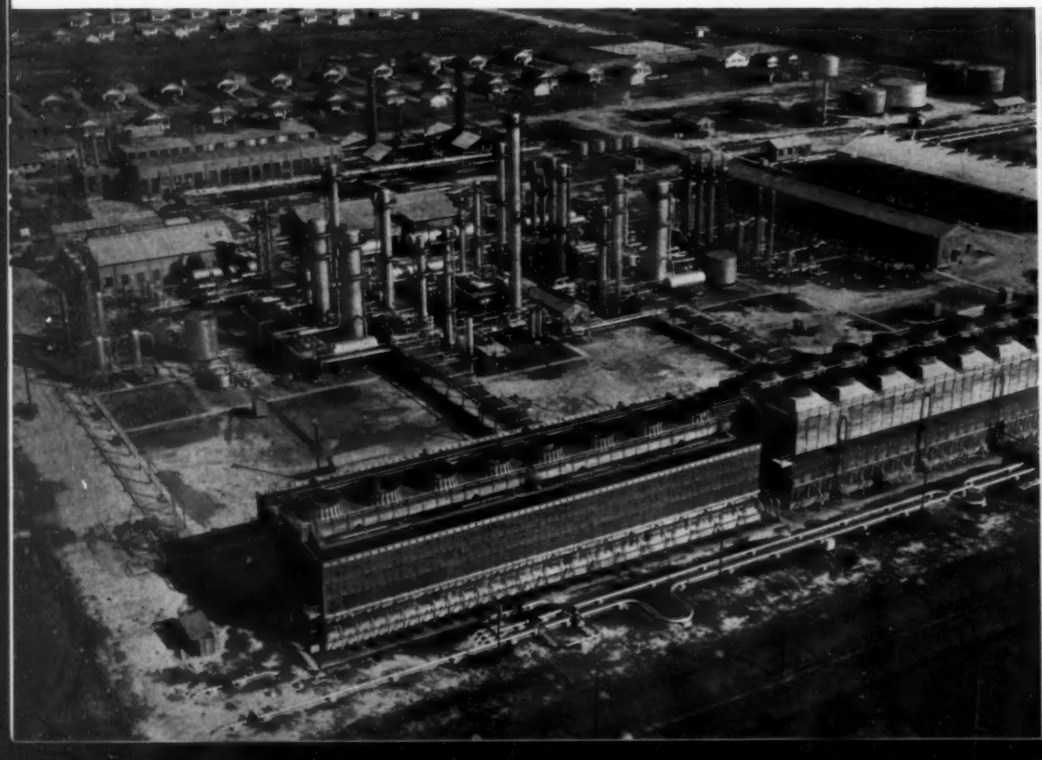
Here, too, the per well yield is high because of the above average liquefiable content of the reservoir gas which is in this case in excess of 70 barrels per million cubic feet. It is, of course, obvious that this high well recovery is not to be achieved without an investment in plant which in this instance has been estimated to cost something over $200,000 per well spread over the total number of wells drilled. The estimated yield is based upon a recovery of 91 percent of the reserves in place which admittedly is a high figure. The engineers on the project have estimated that without cycling only 57 percent of the reserves would be recovered.

The engineering development and the techniques of cycling may be said to be thoroughly established. Methods of evaluation have been improved, based upon empirical data obtained from projects in operation. But as in other industries, costs have increased and the development of a cycling project entails large capital expenditures apart from the cost of drilling the wells for producing the gas. Costs today are upwards of 75 percent greater than when the earlier plants were built seven or eight years ago. Extraction efficiencies are imperative for a profitable operation. It must be early determined whether or not the plant will produce a single product or whether the condensate will be broken down into its several components for ready marketing. The design of the plant must take into account the extent to which propane is to be extracted. The investment and the operating cost will be materially affected by the extraction efficiency designed into the plant and the degree to which the condensate will be converted into two or more end products.

The liquid products of the cycling plant encompass the range from propane through a light gas oil. In substantially all of the plants now operating, the propane and some or all of the butane extracted are separated from the rest of the condensate. The light materials may be sold to users or marketers of liquefied petroleum gas or to chemical plants. In some cases, the butane is split into normal butane and iso-butane, the latter being sold as a raw material component for the manufacture of aviation fuel. In two notable cases, chemical plants of significant size were built to process these liquefied gases delivered from the cycling plant by pipe lines. Katy liquefied gas includes propane and ethane and is utilized by Dow Chemical Company while butane taken by Celanese from the La Gloria plant is processed into intermediates consumed in the plastic and rayon industries.

Most of the earlier plants were designed to produce condensate only. Presently, the limited market for condensate brought about diversification of products. Plants of some of the major and independents are set up so that the condensate

Aerial view of Katy cycling plant near Houston, Texas. Humble Oil & Refining Co. photograph.



Rich Oil heaters at Old Ocean Magnolia-Abercrombie plant. J. F. Pritchard & Co. photograph.

moves to refineries for processing and marketing through established channels. The Erath plant near Abbeville, Louisiana, is a noteworthy example. The condensate is separated into three fractions: light ends, a naphtha cut boiling in the gasoline range, and bottoms. The light ends are thereafter blended with the bottoms and only two products are transported to the refinery at Port Arthur by barge and pipe line. The bottoms are processed at the refinery but the naphtha is blended directly into motor fuel. But in many important instances** the cycling plant is supplemented by distillation and fractionation equipment and Ethyl blending facilities so that a rather complete line of light oil products can be manufactured. Thus in addition to the several liquefied petroleum gases, several grades of motor fuel, kerosene, gas oil and absorption oil are produced. The latter is frequently consumed in the plant as the absorption medium employed in the process, but generally a surplus is available for sale. The choice of policy with respect to the disposition of condensate via the pipe line or refinery route as against self-contained refining facilities and the production of end products is determined generally by the proximity to markets, on the one hand, and by the interest of the operator, on the other.

Plants engaged in total processing of condensates to motor fuels have experienced no serious difficulties with meeting specifications in the marketing of their gasolines. It is a rather extraordinary phenomenon that almost without exception, the extracts from condensate reservoirs are free of the usual impurities associated with crude oils and associated gases. Generally speaking, then, the products of these plants require no chemical treatment to meet the corrosion, sulfur or "Doctor Test" specifications of the industry or of the several states. The shortage of motor fuels during the war years and the lower "anti-knock" standards at that time and since due to the shortage of Ethyl fluid have permitted the absorption of all manner of products with a minimum of difficulty. But with the complete conversion to peacetime operations and increasing competition for preferred outlets reminiscent of pre-war days, the distributor, and indeed the ultimate consumer, is becoming more quality conscious. New cars on the road, after an absence of some four years, put emphasis on anti-knock qualities as does the advertising of many leading refiners which suggest that their gasolines have the improved characteristics developed for aviation gasoline during the war.

It has been well publicized that gasoline manufactured by the catalytic cracking process has this quality as does gasoline from vapor phase cracking, while liquid phase cracked gasoline has it to a considerably lower extent. Few small refiners have "cat" crackers and no cycling plant has to this date installed a catalytic cracking unit. No doubt the element of high investment cost weighed in the balance against such installations.

The cycling plant (as well as the small refinery) is able now to produce the commercial grades of gasoline by the addition of Ethyl fluid. These grades run 73-74 octane and 78-80 octane number respectively by the ASTM method. As indicated, octane numbers were higher before the war and they will be higher again. But these relatively high ASTM octane numbers do not necessarily spell fuels comparable in performance to the catalytically cracked fuels or vapor phase fuels. A method of concerting low octane naphthas and gasolines to high octane ratings with a spread between ASTM and Research octane has long been sought and may now be available through a catalytic reforming process*. Several examples showing the possibilities and the range of the process are shown in Table I. A gasoline with an octane number of 48 produced from an East Texas condensate was reformed to a clear octane of 64 under mild conditions and to 74 under more severe conditions. These reformed gasolines were brought up to 81 and 86 ASTM octane by the addition of 3cc of tetraethyl lead. The Research octanes with the same lead additions were 84 and 93 respectively. The high octanes produced and the spread between the ASTM and Research octane, particularly under severe reforming conditions, is significant.

The severe reforming would not have to be practiced at present where the starting material was more or less of the character of the samples referred to as the requirements for top quality fuels have not reached the maximum range to which this type of naphtha or gasoline can be converted. On the other hand, it would appear to this writer that the reformed material cut back with virgin gasoline of the same quality would make an ideal motor fuel from the present competitive standpoint for good performance at high speeds provided by the paraffinic fractions and by the reformed components for the lower speeds. A fifty-fifty blend indicates an ASTM octane with 78+ with a Research octane of better than 82.

The order of cost is indicated to be of such magnitude as to bear a sufficiently low ratio to the investment in the cycling facilities as to make it attractive. Operating costs and conversion loss do not place too great a burden on the plant and provide it with the means of meeting future competition. This writer still** believes that the operator of a cycling plant who has an integrated operation should process his condensate at his refinery if the material can be transported economically to the refinery. But if due to divided ownership, the equities cannot be apportioned satisfactorily, and the plant must be operated as a separate unit, or if the plant is so located as to make the marketing of the materials feasible from the plant location, the operator can do so with the assurance that he can produce end products which will meet the rigid standards of

* *La Gloria Plant; Erath; Wardner, Stratton and Coastal of the Chicago Corporation; Opelika Plant and others.*
** *Katy; Cotton Valley; Lockhart at Banquette and others.*

* *Perco Process, Phillips Petroleum Company.*
** *Paper presented at New York Meeting AIMME; March 1941 Petroleum Technology.*

Shell Oil Company's newest cycling plant at Sheridan, Texas.

today and the foreseeable standards of tomorrow. "In place" refining is perfectly feasible but the movement of the condensate to the refinery eliminates a special manufacturing and marketing problem.

The independent processor of condensate at the cycling plant has several advantages over the refiner of crude oil. He has no inbound transportation cost for his raw material because it is produced on the ground. He is free from most of the problems incident to crude oil refining such as eliminating or reducing sulfur, emulsion troubles and salt. He has a naturally refined stock, the end products of which require no after finishing by chemicals. The composition of the raw material makes for a higher gasoline yield. A final consideration is that the plant, assuming it does not own the gas, pays for the raw material separated from the gas on the basis of a percentage of the value based upon the selling price or its equivalent. Thus the raw material cost increases or decreases with the selling price automatically. The ordinary refiner of crude oil pays the market price for crude oil and sells his products at the market price for those materials with no relation to the cost.

For ready reference Table II is included showing the comparative values of a typical condensate and 40 gravity crude oil for the production of gasoline end products on the basis of product prices prevailing before the March 10th crude price increase.

No effort has been made to suggest the cost of condensate: Each field has characteristics which influence its economics. There is, of course, a cost for the plant processor and a cost for the drilling and the operation of the wells. To mention only one example, it is obvious that the cost of producing condensate at Erath where the yield per million feet of gas processed is several times that contained in the gas processed at Katy, would be considerably less than at the latter plant. The gas processing facilities at Katy are substantially twice as extensive as at Erath. Again, the cost of processing gas from a reservoir in which the bottom-hole pressure is 5,000 lbs. is materially greater than it is in the case of a reservoir where the pressure is only 2,500 lbs., for an important element of the cost of a plant is expended upon the equipment with which the dry gas is returned to the formations in which it was indigenous. The operator of cycling plants must take into account these several factors when evaluating the economics of cycling for a given situation and in determining as well what percentage of the recovered products, or the value thereof, he will be able to offer the owner of the gas in those cases where he plans to process "outside" gas. It may be well to note here that it is particularly important that prospective operators define the producer's and royalty owner's interest in a share of the production or income. Normally, the producer (the well owner and royalty owner as distinguished from the plant owner) is entitled to an agreed upon share of the materials extracted from the gas at the market price for those materials. Except by plain definition, he should not be entitled to participate in the appreciated value of those products as a result of further processing which may be performed at or away from the plant. The additional processing is not contemplated as part of a cycling operation and is made available only at extra cost.

It is not intended that Table II should represent for all cases the value of condensate above the value of crude oil. Some condensates have more (or less) light ends than the sample shown. The excess of butane as may be present has a lower value when sold as liquefied petroleum gas than when sold as motor fuel, and hence is worth less than an equivalent amount of naphtha. Other condensates may have a higher (or lower) percentage of material boiling in the gasoline range while yet other condensates may have larger portions falling in the range of kerosene and distillates. Suffice it to say, however, that with the currently prevailing prices for motor fuel and natural gasoline as against those which obtained in early 1941, the spread in value between a typical condensate and 40 gravity crude oil has more than doubled. Possibly it is the realization of these values which has put a premium upon cycling plant projects and condensate as such even when it is produced in the field separator. This is a radical change from 1941 when this material went begging for a market at the ordinary price of 40 gravity crude oil.

Few condensate reservoirs have as yet been totally denuded of their liquefiable contents by cycling. But as the gas has been "turned over" and becomes dry, that reservoir becomes an immediate source of natural gas for the large transportation systems reaching from Texas and Louisiana to the northern and eastern markets. Some of these reservoirs will yield large quantities of gas for periods ranging from 10 to 50 years. Erath, for example, could supply a hundred million cubic feet a day for more than 40 years while Katy very likely could provide several times that quantity for twice the period.

Table II

Comparative Value of Products from Crude Oil and Condensate

End Products	Gallons	Lead	Value per Gallon	Realizable Value
Condensate				
8% natural gasoline	3.36		$.04	$.1344
29½% reformed gasoline* } 37½% naphtha }	28.14	3 cc.	.07¼	2.8114
15% kerosene & distillate	6.3		.05	.3150
8% gas	3.34		.0075	.0260
2% loss				
Value of Condensate Products from 1 Barrel of Condensate				$3.2868
Crude Oil				
60% gasoline	30.2	3 cc.	.07¼	$2.190
10% kerosene	4.2		.06	.252
18% fuel oil	7.56		.03	.2268
10% gas	4.2		.0075	.0315
2% loss				.0260
Value of products from 1 barrel of 40 gravity crude oil				$2.699
Excess value of condensate products over crude oil products				.587

* 50% of naphtha cut reformed

Table I

Catalytic Reforming—East Texas Distillate

	Sample As Received	Stabilized Sample Reforming Charge	Test 1 Reformed Product	Test 2 Reformed Product
Yields				
Dry gas, Wt. %			8.3	18.2
Catalytic Gasoline, Vol. % 10#—400 E.P.*			94.2	78.4
Octane Numbers				
ASTM Octane No.	53.0	47.6	64.0	74.6
+1 cc TEL	66.0	59.9	73.7	81.8
+3 cc TEL	76.8	73.0	81.0	86.0
Research Octane No.	51.4	47.0	64.4	79.9
+1 cc TEL	60.8	57.1	74.7	88.2
+3 cc TEL	77.7	72.8	84.1	93.0
Reid Vapor Pressure	9.2	6.0	10.0	10.0
Olefines in Reformer Effluent, Wt. %				
Ethylene			2.0	6.2
Propylene			3.3	8.2
Butylene			3.3	7.0

* Includes polymer gasoline from unsaturates produced in catalytic reforming and n-butane to 10# R.V.P.

(These data by private communication)

The lagging discoveries of new crude oil reserves and the unprecedented and unanticipated demand for petroleum and its products have combined to bring about long-due increases in the prices of the materials. The price of petroleum products is still below the price index for other commodities. Higher crude oil prices and the demand for petroleum products will give impetus to the construction of synthetic gasoline plants sooner than anticipated. Reference is, of course, made to the modified Fischer-Tropsch processes by which natural gas can be converted to liquid fuels.

Several engineering and refining groups have improved the original processes both in the direction of improving the quality of the products and in greatly lowering the investment. If the plant described in the Refinery Issue of 1946, WORLD PETROLEUM is considered typical, it will require 64 million cubic feet per day to produce 5,800 barrels of motor fuel of 80 octane number, 1,200 barrels of diesel fuel and 20,000 gallons of alcohols. A large number of condensate reservoirs when denuded of their liquefiable content could afford long-term supplies of gas for plants of this magnitude. The extraordinary high investment required for the synthetic plant makes mandatory a long-term supply of gas.

Gas gathering facilities and other plant equipment in a cycling plant could be converted for use in the synthetic plant. In some cycling situations producing from multiple sands, gas from a denuded sand could promptly be made available for use by a synthetic plant, provided, of course, the supply was adequate. Several such situations are available. One synthetic gasoline plant under consideration by a major company for location on the Gulf coast* undoubtedly is associated as to gas supply with one of the cycling plants in the vicinity which has one of the largest gas reserves in the country. The possibilities inherent in combining the products of this cycling plant and the high octane gasoline produced at a synthetic gasoline plant are provocative. In areas not reached by pipe lines, a market for gas to a synthetic plant will be a boon to well owners.

The thirty plants in Texas, two in California and five in Louisiana account for some 80,000 barrels a day of condensate and 11,000 barrels of liquefied petroleum gas. This is not a negligible production per day of materials so largely motor fuel in composition, but it does not represent a threat to the oil economy as some feared it would a half dozen years ago. More than half of today's capacity was developed in the first few years, after cycling was demonstrated as a workable and economic process in 1938 in Tide Water Associated and Seaboard's Cayuga plant, from reservoirs hitherto discovered and partially developed. The rest of the production has come from more recently discovered condensate pools. The deeper drilling of recent years which is now the rule in some areas rather than the exception, uncovers an increasing number of reservoirs of this type. But all of them do not lend themselves to exploitation by cycling. More frequently than not, the area and reserves are insufficient or the character of the structural conditions of the reservoir indicate cycling to be unfeasible. This explains why, although there are several hundred known condensate reservoirs, there are scarcely forty plants in operation today. While new discoveries are unpredictable, condensate reservoirs will be located and developed as they have been in the past and they will make substantial contributions to the available supply of motor fuels, LPG and natural gas.

* WORLD PETROLEUM, November 1946

Model of new Shell chemical plant to be built in Cheshire.

NEW BRITISH CHEMICAL PLANT

ERECTION of a large-scale petroleum chemical plant in England was announced by Shell Petroleum Co., Ltd., on March 10 at a press reception at the Mayfair Hotel in London. The new plant will be built on a site of 85 acres which has been obtained at Thornton-le-Moors, Cheshire. Investment in the plant will total several million pounds sterling.

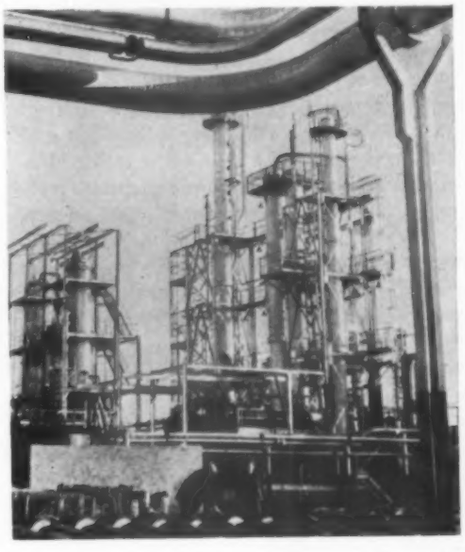
Enlargement of the present Shell oil refineries at Stanlow on the Manchester ship canal and at Shell Haven, Essex, also was announced at the same reception. The Stanlow refinery will double its present production of 24,000 tons per year of synthetic soaps, cleansing agents and wetting agents for industrial and domestic uses. The Shell Haven plant which produces insecticides, fungicides, eventually will produce 30,000 tons yearly of these chemicals.

To supplement its present research work at Thornton, Shell has acquired an experimental farm of 170 acres at Woodstock, Kent. Studies will be conducted of pests and diseases of plant life and improved methods of applying insecticides. Close liaison will be maintained between research centers and the manufacturing units, some of which are the first of their kind built by the Shell group.

Chemical products at Thornton will include materials for use in the manufacture of paints, plastics, textiles, rubber, leather and chemical and pharmaceutical preparations. British supplies of coal and fermentation by-products have been insufficient for home consumption. The new Shell plants will bridge this gap and provide a surplus for export. Since petroleum will be used entirely as the base for the soaps, the plant will help relieve the shortage of edible fats and oils.

Shell Chemical Manufacturing Co., Ltd., will control the manufacturing phase of the new operation. Sales will be handled by Shell Chemicals, Ltd., formerly Technical Products, Ltd.

Ester salts plant of Shell Petroleum Co. at Stanlow, England. British Combine photo.



UNION OIL PRESIDENT RECEIVES AWARD FOR YEAR'S BEST PUBLIC RELATION JOB

EACH year the American Council on Public Relations presents an award to the individual who has contributed most to the promotion of sound public relations during the preceding twelve months. Latest recipient of this signal honor is Reese H. Taylor, president of Union Oil Company of California, the primary basis for his selection being the "Free Enterprise" series of advertisements which Union has been carrying in its marketing area and in national magazines.

This institutional campaign was started back in 1943. While the copy used refers to the company's operations and to its products, it is entirely separate from the sales promotional advertising and is designed to serve a different purpose. The idea behind it grew in Mr. Taylor's mind from his observance of the widespread lack of understanding of the nature of corporate enterprise and the fact that, while active dissemination on misinformation on the subject was going on, very little was being done to place the truth before the public in simple and readily understandable terms. As approved by the company management and worked out by Mr. Taylor with the aid of the company's advertising staff and agency, five major topics were adopted as a basis for the campaign. Put in question form these are: (1) What is a corporation? (2) What happens to profits? (3) Why do some corporations grow large? (4) What part has free competition played in developing American industry? (5) What have corporations and competition contributed to the American standard of living?

Each piece of copy develops some phase of one of these themes, always in terms of the Union Oil Company but always with application to the broad fundamentals of modern business. While the advertisements are conveniently referred to in company circles as the "Free Enterprise" series, they could be described with equal accuracy as the ABC of the American way of life or perhaps as a primer of the capitalistic system. Simplicity is the keynote in all copy. Under a striking headline three columns wide appear a series of pictures something on the order of those that used to adorn the pages of a child's first reader. Underneath each picture is a short explanatory paragraph. One advertisement, for example, answers the question put in a bold headline, "Who Gets the Money Union Oil Makes?" Beneath the series of illustrations, copy explains that the company took in 127½ million dollars during a year, of which 91 million was paid out for *things*—rent, materials, transportation, equipment, depreciation, interest and taxes. This left 36½ million which was divided among *people*—27½ million to employees in wages, salaries and benefits; 4¾ million to owners in dividends; 4¼ million left in the business. Thus the employees

Reese H. Taylor

got 75 percent of what money there was to distribute, while the owners got 13 percent and the business retained 12 percent. The 4¼ million handed over to owners was divided among 32,000 stockholders, while the 27½ million paid in wages was shared by less than 9,000 employees—an average of $3,108 apiece. On their capital investment the owners received 3.2 percent for providing each employee with $43,525 worth of tools and facilities that enabled him to realize his earnings.

No moral is appended to the story, but it provides a simple arithmetical demonstration of the mutual dependence of owner and worker and the equitable division of the proceeds from their joint enterprise.

There is no attempt to camouflage the purpose of the advertising. The approach is bluntly direct. One piece of copy is headed, "There's only one way to raise wages." The illustrations are graphs showing the rise in the remuneration of employees over the past twenty years, both in money wages and purchasing power, the increased investment in "tools" per employees and the growth in average production for each worker. Combining these charts in the final graph provides visual demonstration that the only real way to raise wages is to raise production.

Each advertisement carries an invitation to readers to send suggestions and criticisms directly to the president of Union Oil Company. This suggestion has brought a liberal response, and while no attempt has been made to compile a set of statistics on the thousands of letters that have been received, Mr. Taylor says that between 85 and 90 percent are favorable in tone and commend the company for its efforts. He knows the public reaction better than anyone else, for he reads and answers every letter received.

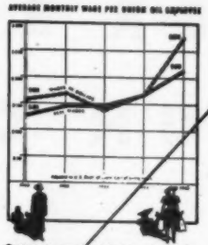
Although it is difficult to single out one phase of a company's activities as the reason for increased sales and increased goodwill, the Union Oil management feels that this campaign is helpful in both respects. Mr. Taylor declares that if for any unforeseen reason it might become necessary to curtail advertising expenditures, the institutional campaign would be the last to go. In this statement, he not only has the support of the company's advertising agency, Foote, Cone & Belding, but the sales department also is in hearty accord. The agency supports its stand by saying that the number of letters received in response to this campaign is far greater than could normally be expected and that surveys have shown exceptionally high readership of the material. Salesmen have found that the ads have aroused a great deal of interest among dealers and customers. They seem to like Union's approach. They feel that a company that talks frankly and openly about shareholders and profits and competition deserves their confidence. Advertising men and salesmen agree that, everything else equal, if the people like a company they will be inclined to buy that company's products.

Approximately every five weeks one of this series appears in every daily paper in Union's marketing territory, which includes Hawaii and Alaska. In addition to more than 200 daily papers, the ads are placed in college publications, parent-teacher magazines, some technical journals, several national magazines, and Union's own publication, "On Tour," which is delivered to each employee at his home.

To date the company has spent some $2,000,000 on the campaign, and satisfaction with results is reflected in the decision to maintain it. Currently the series is scheduled to continue throughout 1947 at a cost of more than a quarter million dollars, and Mr. Taylor sees nothing in the future that will make the Free Enterprise theme any less important in 1948. While he heartily supports the educational job being done by some business and industrial associations, he also believes there is some very fundamental and essential work which can only be done by individual companies and corporations.

Samples of some recent Union Oil advertising. →

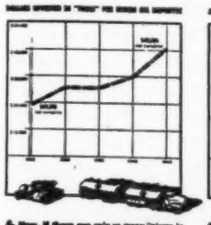
There's only one way to raise wages

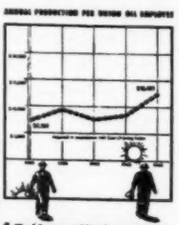


1. Look your business problem as much in the face. Part of that income goes for rent, raw materials and other expenses. What's left is divided between the employees and the owners—as wages and profits. Many people think wages can be raised by giving employees a bigger share of the income that's left. But in 9 cases out of 10 this can't be done.

2. In most U. S. businesses the employees are already getting a lion's share of the income. Last year, for example, Union Oil employees got 77¢ of all revenue the company produced over expenses. (The stockholders got 12% in dividends and 11% was plowed back into the business.) Nevertheless, employees' wages since 1939 have almost doubled.

3. Here's the average Union Oil employee's wage in actual dollars per month (dotted line above). Of course $1 today won't buy what it bought—say—in 1936. So we've also converted these dollars into "Real" Wages (solid line). This shows what the U. S. Dept. of Labor Cost of Living Index found the pay check would actually buy each year in food, clothing, etc.





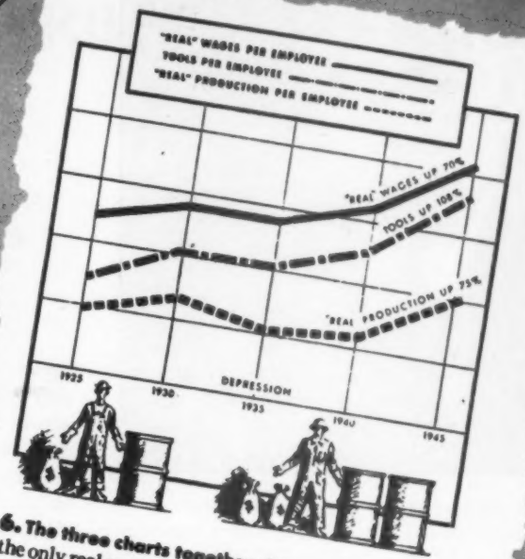
4. Here, if there are only so many "pieces in a pie," how were wages increased that much? Mainly by producing "bigger pies." In 1939 each Union Oil employee had an average of $10,276 worth of "tools"—all tanks, pipelines, trucks, etc.—to work with. By 1945 the owners had provided him with $40,000 worth—twice as much.

5. "Tools" are one thing that enable people to multiply the labor of their hands. Today, Union Oil people work about 20% fewer hours than in 1939. They have better vacations, hospital and pension plans. But because they have more "tools" with which to work, they can produce more. And because they can produce more, per employee, they are able to earn more.

This series, sponsored by the people of Union Oil Company, is dedicated to a discussion of how and why American business functions. We hope you'll feel free to send in any suggestions or criticisms you have to offer. Write: The President, Union Oil Company, Union Oil Bldg., Los Angeles 14, Calif.

AMERICA'S FIFTH FREEDOM IS FREE ENTERPRISE

UNION OIL COMPANY
OF CALIFORNIA



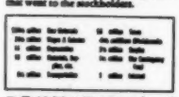
6. The three charts together show graphically that the only real way to *raise wages* is to *raise production*. Union Oil is not unique in this respect. Almost every U. S. business plots out the same. But one word of warning: Until recently, stockholders have always had the *incentive* to provide *more* and *more* "tools". Today, much of that *incentive* has been whittled away. Unless it is restored, we're not going to have the progress in the future that we've had in the past.

What happened to our 110 million dollars?

1 During 1945, Union Oil Company took in 110 million dollars from the sale of its products. But at the end of the year, the people who own the company (and there are more than 51,000 of them) wound up with just 4¢ off of this in dividends. What happened to the rest?

2 Well, the largest single share, 34¢ million dollars, was paid out for the raw materials from which we manufacture our finished products. The next largest, 24¢ million, went to Union Oil employees who got approximately $5.21 in wages and salaries for every $1.00 that went to the stockholders.

3 Another 16 million went for depreciation of tools, oil fields and equipment—all of which have to be replaced as fast as we "wear them out." 13 million went for materials, supplies, research and other expense. 6¢ million was spent in transporting our products to our customers.



4 9 million was paid out to local, state and federal governments in taxes. Interest charges took another 1 million, and 1¢ million was put into a wartime contingency fund we've had to set up because of abnormal operating conditions. The last 2¢ million was plowed back into the business.

5 That left just 4¢ million to be paid out in dividends to the 51,373 Americans who own Union Oil—an average of $148.73 per stockholder. Since these stockholders financed all the oil wells, refineries, service stations, etc., without which we simply couldn't do business . . .

6 . . . this seems a reasonable enough return. For the only alternative to this *private financing* of American industry would be government ownership, which would eliminate the freedom of the individual, the efficiency of a free economy, and that all-important human incentive—competition.

UNION OIL COMPANY
OF CALIFORNIA

AMERICA'S FIFTH FREEDOM IS FREE ENTERPRISE

These stories have complete information on the material in this advertisement may refer to the Annual Report to Stockholders and Employees which we will gladly furnish on request. We would also appreciate your comments or suggestions. Write: The President, Union Oil Company, Union Oil Building, Los Angeles 14, California.

Each Union Oil employee has a $38,000 kit of tools

1. You may know how to drill an oil well, but you can't do it with a pen-knife dagger. You may know how to make gasoline, but you can't make it in a coffee pot. The man who drill oil wells and make gasoline have to have "tools." Otherwise, all their skills would be useless.

2. These "tools" in the oil industry have become very complex. Refineries, drilling rigs, pipe lines and even service stations are far more complicated and costly than they used to be. Consequently, it takes an average of $38,000 worth of "tools," today, *for each employee* in Union Oil Company.

3. How common has it become these "tools" . . . and just for one last fact: 51,000 Union Oil employees. Very few individuals in this country could put up that kind of money. So we have pooled the money of *a lot of people* under a legal agreement known as a corporation. That way we divide the cost among 51,000 individuals—called stockholders.

4. These people, who own Union Oil Company, have chosen to put their savings into "tools" that produce gasoline and petroleum products for *other people*, instead of spending it on goodies such as automobiles and refrigerators—for themselves. For that reason they are entitled to some compensation.

5. They get this in the form of dividends—whenever the company makes a profit. Last year these dividends averaged $127.48 per stockholder. In other words, for a very modest share of the proceeds of the business, these owners have "plowed back" the employees to the "tools" they need.

6. In view of the money required, the only other way oil "tools" could be provided would be through government ownership. But we Americans have chosen to do it under our free competitive enterprise system. For in that way, we can preserve the *freedom* of the individual, the efficiency of a free economy, and that all-important human incentive—*competition*.

UNION OIL COMPANY
OF CALIFORNIA

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AMERICA'S FIFTH FREEDOM IS FREE ENTERPRISE

J. HOWARD PEW RETIRES AFTER 35 YEARS AS SUN OIL HEAD

J. Howard Pew

J. HOWARD PEW, president of Sun Oil Company for 35 years, retired from the presidency on March 18 at the time of the annual stockholders' meeting. Joseph N. Pew, Jr., his brother, who has been executive vice president, was elected chairman, a new post, and Robert G. Dunlop, comptroller, was elected president. Stockholders voted to create an executive committee and to increase the number of directors to 15.

Arthur E. Pew, Jr., resigned as vice president in charge of manufacturing at the same time. He will continue as a director, however. New vice president in charge of manufacturing is Clarence H. Thayer who has been chief engineer. In announcing his retirement, J. Howard Pew reminded directors that he "desired to withdraw from the active management of the company five years ago, but the war made that impossible.

"The war is now over," he said. "I have passed my sixty-fifth birthday. I feel it is essential to have more time to devote to my personal affairs. Therefore, I feel the time has come for me to turn over to younger, more vigorous men the burden of active executive responsibility which exceptionally good health has enabled me to carry all these years.

J. Howard Pew was born at Bradford, Pennsylvania, January 27, 1882, and at the age of 19 he joined Sun as an engineer at the Marcus Hook refinery which was being built by his father, Joseph Newton Pew, Sr. Later he became assistant superintendent, superintendent and, in 1906, vice president. Upon the death of his father in 1912, he was elected president of what was then the Sun Company, but which in 1922 was changed to Sun Oil Company. He has continued as president since that time. In 1912, the year he assumed the presidency, the company did a volume of business of less than $5,000,000. Under his management the company has developed and expanded to the extent that in 1944 it did a volume of business of more than $600,000,000.

During World War I Mr. Pew served in Washington as a member of the National Petroleum War Service Committee, out of which grew the idea of forming the American Petroleum Institute, the trade organization representing the petroleum industry. Mr. Pew has been a director of the Institute since its formation and was vice president for refining from 1939 to 1946.

During World War II the petroleum industry set up an organization in Washington, known as the Petroleum Industry War Council, to serve as a liaison organization between the petroleum industry and the government's Petroleum Administrator for War. Mr. Pew was a member of this council and devoted a great deal of time to its deliberations.

Joseph N. Pew, Jr., new chairman, has been associated with Sun since graduating as a mechanical engineer from Cornell University in 1908. He started to work in the purchasing department and after a year went to the oil fields where he spent about one-half his time for the next five years. During this period he also assisted his father, the founder of Sun Oil Company, in the administration of the company's affairs in Philadelphia. He became vice president and director in 1912.

In the late 1920's, Mr. Pew developed a plan for transporting gasoline by pipeline from the Atlantic seaboard to the Great Lakes, and persisted in his belief that such an idea was practical despite doubts expressed by many engineers. Sun oil Company completed such a pipe line from Marcus Hook, Pa., to Cleveland, Ohio, in 1931. Since that time thousands of miles of such lines have been constructed.

Robert G. Dunlop, newly-elected president, was appointed comptroller of Sun and elected to the board in January, 1944. He was then 34 years of age, and had been assistant comptroller for three years. He first joined Sun in 1933 after two years of experience with an accounting firm. His early activities with the company included a complete survey of producing, refining and marketing operations in the light of new requirements imposed by the NRA Petroleum Code.

Through this work he gained extensive knowledge of all phases of Sun Oil Company's operations, as well as those of the petroleum industry generally, and was particularly adapted to assist in the preparation of testimony presented by the industry before the Temporary National Economic Committee in 1939.

When the news of his appointment as comptroller and election to the board of directors of Sun Oil Company was announced in January 1944, it was about the first time anyone around the company's offices had ever heard the 34-year-old Mr. Dunlop referred to except as "Bob."

Although his personality belies an association with balance sheets and income statements, he has been a Certified Public Accountant since 1934 in the State of Pennsylvania, and is a member of the Comptrollers Institute of America, and director of the Philadelphia Control. He is also a member of the American Petroleum Institute and currently is serving as vice chairman of the Financial and Accounting Committee of the Institute, as well as chairman of sub-committee in cooperation with the Securities and Exchange Commission.

Clarence H. Thayer | Robert G. Dunlop | Joseph N. Pew, Jr.

COOPERATIVES PLAN INTERNATIONAL EXPANSION

by RUTH SHELDON

DURING this month of April a group of men from Sweden, South Africa, Scotland, Switzerland, France and the United States will meet to launch officially a new and controversial phase of international oil operations—the first International Cooperative Petroleum Association.

What started after World War I as a simple distributive movement among farmers in America to lower petroleum product costs by bulk cooperative buying is emerging from World War II as a potential "international trust buster number one," according to the prediction of the Association's temporary board chairman, A. Johansson of Sweden.

Already prepared to participate in ICPA, which was formed in Zurich last October at the 16th Congress of the International Cooperative Alliance, are twenty-two national cooperative organizations from Argentina, Australia, Belgium, China, Cuba, Egypt, Finland, France, Greece, Iceland, Italy, Netherlands, Norway, Palestine, Philippines, Puerto Rico, Scotland, Siam, South Africa, Sweden, Tunisia and the United States. These consumer and agricultural cooperatives, some of which began almost a century ago, are so confident of the possibilities afforded by the international petroleum trade that even in advance of the first official meeting, pledges have been given to subscribe $900,000 of the authorized $15,000,000 capital.

It is a direct challenge to the commercial oil interests that, while they are still involved in controversial discussions concerning the necessity for international collaboration on oil affairs and the form it should take, the large-scale co-ops which enroll over 100,000,000 members in 40 countries have decided to take a short-cut of their own.

If this short-cut is as successful and meteoric in growth as the American petroleum cooperatives have been, it will provide serious world competition to the commercial oil companies. The new international petroleum cooperative, as a non-profit service organization, has as its objective the lowering of petroleum costs to its members throughout the world. In order to accomplish this, it plans to engage in every phase of oil operation. Beginning its trading activities on a brokerage basis it intends ultimately to own and control crude reserves, tankers, pipelines and refineries.

It is perhaps significant of the organization's ambitions as a factor in world oil politics that it has its eye fixed primarily on the Middle East, cradle of future world oil supply. The proven and potential reserves there are so tremendous and the present ownership divided among so few companies that the cooperatives as well as other independent groups maintain the area should be opened to more extensive competition.

The cooperatives go so far as to propose that all Middle East oil be placed under United Nations authority. Howard Cowden, secretary of the International Cooperative Petroleum Association and president of Consumer's Cooperative Association of Kansas City, believes that Middle Eastern oil should be placed under an International Oil Development Authority, just as is proposed for atomic development and for the same reason—that oil, no less than the atom bomb, may explode into a third world war unless it is placed under controls which really control.

Cowden is the spark-plug of this broad cooperative plan. His spectacularly successful development of American petroleum cooperatives is the basis of the cooperative belief in the success of its new world enterprise. As a matter of fact he initiated the first world oil cooperative trading in 1934 on his first visit to Europe.

The Kansas City Consumers Cooperative Association was then only a motor oil compounder. However, due to the non-profit feature of the organization, he was able to arrange to export oils from Kansas City to European cooperatives on a competitive basis with the commercial oil companies. Many European cooperatives became early members of the American Association.

Cowden then envisioned the possibilities of a world setup where cooperatives would actually engage in all oil operations. He proposed such a plan to the International Cooperative Alliance Congress at Paris in 1937. The idea seemed fantastic at the time, for even his own organization had not yet experimented in the field except in a very minor way. In addition the European war cauldron was beginning to boil, so the idea remained simply an idea.

Cowden returned to the United States determined to demonstrate the feasibility of his plan. In 1939 his CCA built its first refinery in Phillipsburg, Kansas, and shortly thereafter drilled its first well—a producer. Today CCA owns three petroleum refineries with a daily capacity of 28,450 barrels and has a third interest in a fourth of 17,500 barrels. It has over 700 producing wells in four states which it has either drilled or purchased and which supply its refineries with approximately half their needs. It has more than 1,000 miles of pipe line, including products lines. Last year nearly three million gallons of Co-op motor oil were

Albin Johansson, general manager of Kooperativa Forbundet and chairman of the International Cooperative Petroleum Association.

Howard A. Cowden, president and general manager of Consumers Cooperative Association at Kansas City, since 1929.

shipped to cooperatives in Australia, Belgium, Canada, China, France, Holland, Norway, Sweden, Tunisia and the Union of South Africa. They also purchased quantities of grease and refined products.

CCA inspired the development of other petroleum cooperatives in the United States. There are now a total of 11 cooperatively owned refineries, including CCA's three, with a total refining capacity of 69,800 barrels daily. Seventeen major regional wholesale cooperatives distribute over $70,000,000 of petroleum products and accessories annually. There are 2,327 local cooperative service stations doing $197,000,000 worth of business annually.

Petroleum cooperatives have grown so fast in their 17 years of existence that they have taken the commercial oil industry by surprise. There is relatively little understanding of just how they operate or the reasons for their success, and it is necessary to know these factors in order to evaluate the significance of their organized entry into the international field.

A consumers cooperative is operated as is any other commercial producing, marketing or purchasing business. The difference lies in the fact that the co-op provides goods for its shareholding members themselves to use, and the co-op makes "savings" for its members rather than "profits." These savings are divided in two ways among the shareholders or members: (1) a "limited interest" on shares; and (2) a "patronage savings return" on purchases. The "limited interest" (usually not exceeding four or five percent) is considered an operating cost. Only such interest is paid as is necessary to secure needed capital. The "patronage savings return" is the real net of the cooperative. It is returned to the patrons in proportion to their purchases or their use of the business. In other words the shareholding members as purchasers obtain their goods at cost and retain for themselves the gains from manufacturing, wholesaling and retailing that would provide the profits of the ordinary corporation engaged in such operations.

Since it is impossible to know in advance the exact cost of producing goods or service, the co-op places the commercial market price on its products and returns, at the end of the year, as a saving on purchases any amount remaining after exact costs are determined. The net savings are shared with members and non-members alike. However, instead of returning cash patronage savings to non-members, they are usually given credit toward purchase of shares which enables them to become members without any original cash investment.

In order to secure working capital and expansion funds, the co-op does not distribute all the patronage savings or refunds, but withholds 50 percent to 100 percent which is treated as a deferred patronage refund and for which it issues evidences of indebtedness. Co-op members also contribute loan capital by purchasing preferred shares at 2½ percent annual interest.

When a co-op in China or South Africa purchases petroleum products from the CCA in Kansas City, it is credited with savings just as a member association or an individual member in the United States. When patronage refund distributions are made, this credit is turned into shares of CCA, and it becomes a full-fledged voting member and receives its future savings in cash or in equities.

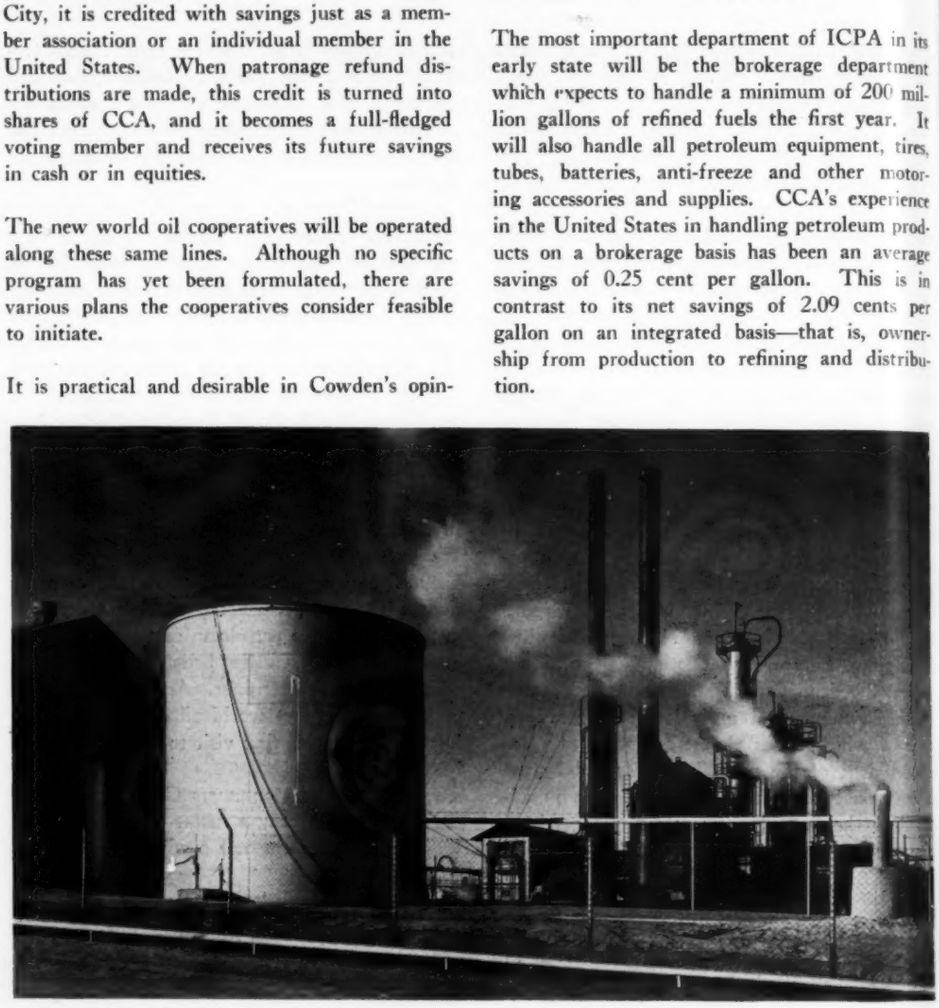
The new world oil cooperatives will be operated along these same lines. Although no specific program has yet been formulated, there are various plans the cooperatives consider feasible to initiate.

It is practical and desirable in Cowden's opinion for the cooperatives of France, Belgium, Holland and Switzerland to join together and lease or buy petroleum storage facilities in Antwerp large enough to handle tanker loads of refined products. Products can be distributed from there over a large part of the four countries. Also barge shipments on the Rhine and truck transport could service Germany from this central point when its cooperatives have been reconstituted. Later, these same cooperatives may find it practical to operate as a federation in constructing and operating refineries, purchasing crude oil rather than finished products from ICPA.

The Swedish co-ops already own petroleum terminals throughout Sweden and a part interest in a tanker. They plan to build a refinery large enough to meet their own member demands and possibly those of other Scandinavian countries. Here again ICPA would supply them with crude oil.

ICPA may build a refinery in Texas, where CCA already has oil production and where more could be acquired. Such a refinery would be small, approximately 10,000 barrels per day, and would supply half of the anticipated requirements of the world co-op in the beginning.

The most important department of ICPA in its early state will be the brokerage department which expects to handle a minimum of 200 million gallons of refined fuels the first year. It will also handle all petroleum equipment, tires, tubes, batteries, anti-freeze and other motoring accessories and supplies. CCA's experience in the United States in handling petroleum products on a brokerage basis has been an average savings of 0.25 cent per gallon. This is in contrast to its net savings of 2.09 cents per gallon on an integrated basis—that is, ownership from production to refining and distribution.



First cooperatively owned refinery in the United States built in 1939 in Phillipsburg, Kansas.

The brokerage business is only the starting point in the program, however, as ICPA will begin building refineries as soon as possible. At the same time it will explore the possibilities of acquiring production either in the United States or South America and of obtaining concessions in the Middle East, to which it looks for enough oil to satisfy all permanent requirements.

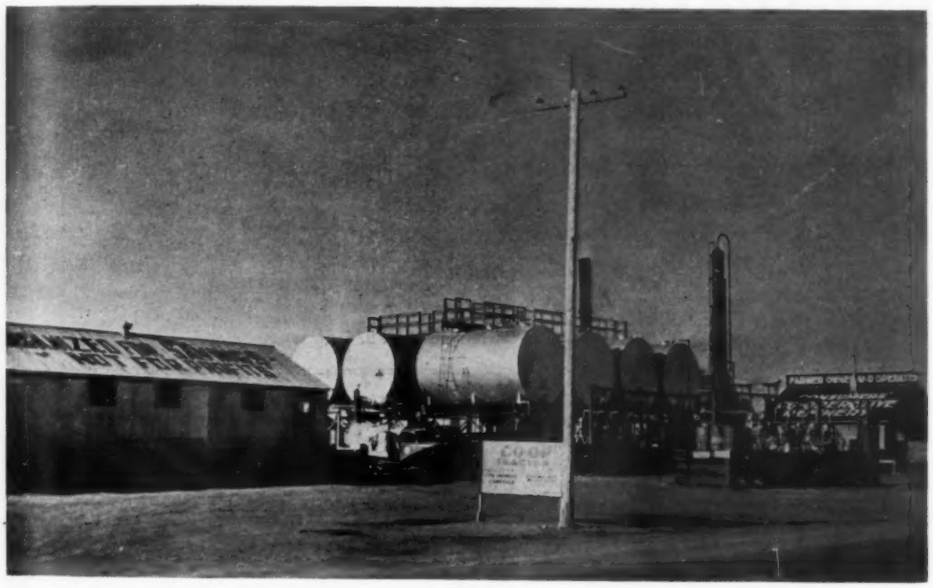
The International Cooperative Alliance, under which ICPA is organized, is a consultant to the Social and Economic Council of the United Nations. It plans a vigorous presentation of the cooperative viewpoint to this body, not only in regard to enabling the ICPA to enter the competitive oil situation in the Middle East but to have the United Nations actually administer Middle East oil resources.

The impact of the new world oil cooperative upon the international oil situation will be out of all proportion to its size, Cowden believes.

"The petroleum industry generally is well aware of the potentials of the cooperative movement," he states. "Owned by cooperatives of all countries, on a one-member-one-vote basis, with savings distributed on a basis of patronage, it would be a start toward giving European customers particularly some relief from cartel-rigged petroleum prices."

Cowden also expects the ICPA to become the forerunner of other international cooperative activities. The Swedes and Scots are manufacturing electric light bulbs together in Glasgow. Already there is a movement afoot to broaden the ownership base of this factory to include other cooperative wholesalers.

The Swedish cooperative makes patented cash registers and adding machines, and its president, A. Johansson, who is also president of ICPA, has suggested that their manufacturing should be extended through a cooperative setup with members in many countries. The Swedish cooperative, which buys co-op motor oil in Kansis City, is now exporting to the United States co-op cash registers which sell, duty paid, much below comparable American makes. The Swedes are also importing co-op manufactured milking machines made in Waukesha, Wisconsin.



Farmers cooperative oil refinery at Regina, Saskatchewan, Canada. James Sawders-Combine photo.

The great diversification of the cooperatives is one of their strong appeals and inducements to membership. For example CCA, with its 1,015 member associations which have a total of approximately 250,000 members, is not a petroleum wholesaler alone. Aside from its comprehensive oil holdings and operations, it has a vegetable cannery in Nebraska which produced four million cans of food products last year. It has a Cola bottling plant, feed mixing mills, a soybean processing plant, a dehydrated alfalfa meal plant. In Oregon it owns a lumber mill which turns out 10,000,000 board feet annually and owns enough virgin timberland to supply it for several years. It has a paint factory, a grease compounding plant, liquified gas plants. It wholesales tires, tubes, auto accessories, batteries, anti-freeze and household appliances. It has its own warehouses, transportation depots, repair shops. Through its association with other regional co-ops, it brings its members cooperatively manufactured flour, tractors, milking machines, farm implements, corn pickers, chemical products, hot water heaters, shingles and cottonseed oil.

Domestically as well as internationally the co-ops are in a position to satisfy almost every need of their consumer members at a savings and to offer serious competition to the commercial suppliers in the same fields.

In the early days of cooperatives in the United States the movement had its most rapid growth in rural communities. Farmers joined together to purchase feed or fertilizers at wholesale rates, thereby effecting a substantial saving. Dairymen, dissatisfied with the prices paid by the dealers to whom they sold, pooled their interests to undertake the serving of the ultimate consumers of their products. Fruit and vegetable growers built community canning factories to provide an outlet for their crops. These were local enterprises, most of them small in size, and they attracted little attention or opposition. Consumers' cooperatives, a later development, acquired large memberships and covered a broad field of merchandising. Today cooperatives are definitely big business and are able to compete successfully with the largest private corporations.

One element in the financial growth of the cooperative is much more emphasized by its foes than by its supporters. Being non-profit organizations, the cooperatives are exempted from the payment of taxes. When their operations were small and when taxes themselves were low, this advantage was not of serious concern to competitors, but now it is of sufficient importance to spell the difference between success and failure in many instances.

Critics of the cooperative maintain that in its present form it differs in no important respect from other capitalistic concerns except that it is subsidized by its exemption from taxation. They contend that its "savings" are in reality "profits" and that the co-op should pay taxes on them just as a commercial corporation does. Neither do the co-ops pay tax on the deferred patronage refunds which provide them with working and expansion capital, which has been a tremendous advantage to them, particularly during the recent years of high taxation.

The National Tax Equality Association has conducted a vigorous campaign to prove that the co-ops should be taxed on the savings to their members. Extensive hearings on the question were held during 1946 before the Committee on Small Business of the House of Representatives. Although the committee made minor recommendations concerning changes in legal supervision of cooperative activities, it concluded that "the Bureau of Internal Revenue has ruled, and the courts have upheld, the principle that the cooperative entity serves only as an agent for and on behalf of its members and that at no time does its income belong to other than its members. Since the apparent intent of the Congress in levying taxes has been to levy on ability to pay, it does not appear to be reasonable or equitable to attempt to levy a tax on a cooperative for income which does not belong to it nor to levy a tax for which it has no funds to pay."

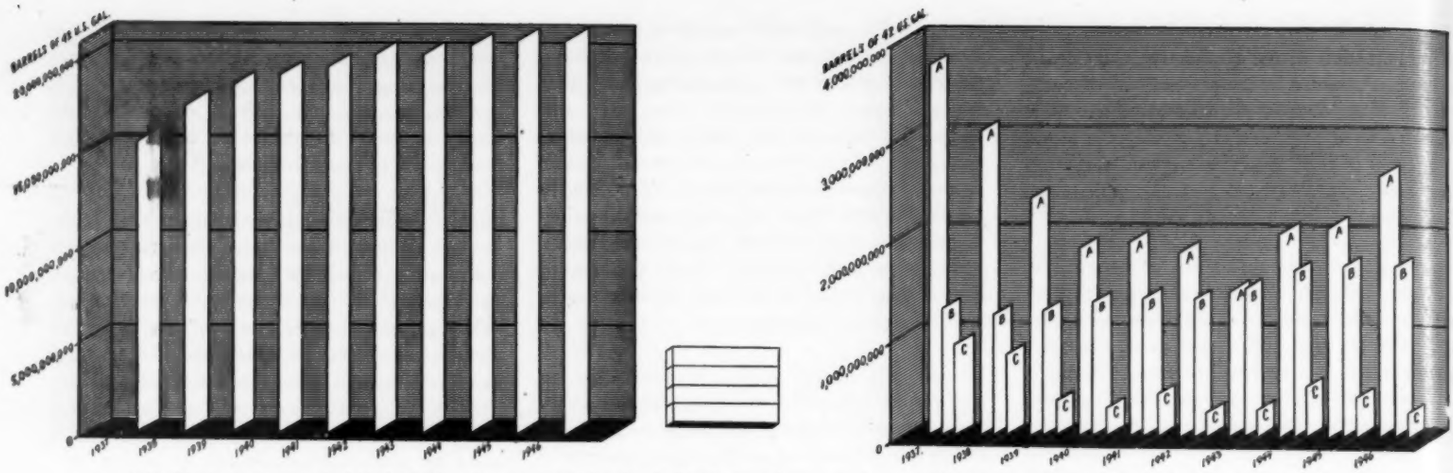
The Committee also stated that levy of a receipts tax would mean that all non-profit organizations, such as schools, churches, charitable and scientific organizations and social clubs, would also have to be taxed as they have a comparable advantage of tax exemptions.

The Committee further pointed out that "there is substantial evidence to show that the cooperative movement operates as a very successful means of combating monopolistic concentrations and, as such, is a very healthy addition to the Ameircan economy."

The tax dispute is by no means ended even though the co-ops have been victorious in the first round. A tax fight is materializing in Kansas this year, and others can be expected in other states. Undoubtedly the matter will continue to be pressed in Congress by the opponents of tax exemption for cooperatives.

The co-ops have had active competition from private companies. Before CCA built its re-

(Continued on page 80)



Left: Chart showing trend of U. S. Crude reserves in past decade. Right: Factors in reserve changes: (A) increases due to extensions and reevaluation of reserves in old fields, (B) Crude produced during year, (C) Crude reserves in new fields discovered during year. Chart at right is enlarged. If on same scale as chart at left it would occupy space shown in small block in center.

REPORTS TOTAL HYDROCARBON RESERVES

Gain of 931 Million Bbls. Shown in Crude Oil During 1946—Natural Gas Liquids Placed at 3,321 Million Bbls.—Natural Gas Reserves Estimated as 160 Trillion Cubic Feet

IN its computation of available oil reserves of the United States as of January 1, 1947, the Committee on Reserves of the American Petroleum Institute has made a marked departure from the practice of previous years. Two principal changes have been introduced. One of these is a matter of classification. In recognition of the growing importance of condensate production, natural gasoline and liquefied petroleum gases, a separate tabulation is made of condensate reserves which formerly were included in the total of crude oil reserves. In cooperation with the Committee on Reserves of the American Gas Association, a calculation has been made of additional natural gas liquid reserves, which have not been included previously in the API Committee report.

Issued in conjunction with the statistics of the API Committee is a report, prepared by the Committee on Reserves of the American Gas Association, on proved natural gas reserves of the country as of January 1. Through the assemblage of all these figures, it is believed that a more accurate picture is presented of the known petroleum resources eliminating all consideration of potential recovery from substitute sources.

In order to facilitate comparison with preceding years, the API Committee included in its report a tabulation of crude oil reserves on December 31 of the years 1945 and 1946, excluding from the former the 884,967,000 barrels of condensate now listed under a separate heading. This com-

Table 3

Summary of API Committee's Report Covering Period 1937—1946

(Thousands of Barrels of 42 U. S. Gallons)

YEAR	NEW OIL BLOCKED OUT DURING WAR: Through Revisions to Previous Estimates and Extensions to Known Fields	NEW OIL BLOCKED OUT DURING WAR: Through New Pools Discovered During Year	NEW OIL BLOCKED OUT DURING WAR: Total Through New Discoveries, Extensions and Revisions	Production During Year	Estimated Proved Reserves as of End of Year	Increase Over Previous Year
1936 ..	.....	.....	.....	.....	13,063,400	.....
1937 ..	2,792,790	928,742	3,721,532	1,277,664	15,507,268	2,443,868
1938 ..	2,243,571	810,493	3,054,064	1,213,186	17,348,146	1,840,878
1939 ..	2,058,455	340,667	2,399,122	1,264,256	18,483,012	1,134,866
1940 ..	1,607,012	286,338	1,893,350	1,351,847	19,024,515	541,503
1941 ..	1,538,989	429,974	1,968,963	1,404,182	19,589,296	564,781
1942 ..	1,618,925	260,051	1,878,976	1,385,479	20,082,793	493,497
1943 ..	1,202,368	282,418	1,484,786	1,503,427	20,064,152	(—)18,641
1944 ..	1,556,192	511,308	2,067,500	1,678,421	20,453,231	389,079
1945 ..	1,690,315	419,984	2,110,299	1,736,717	20,826,813	373,582
1946 ..	2,413,628	244,434	2,658,062	1,726,348	20,873,560	931,714

NOTE: Up to and including its figures on proved reserves of petroleum as of December 31, 1945, the committee combined under that heading the estimated proved reserves of cycle plant and lease condensate. As of December 31, 1945 the reserves so included totaled 884,967,000 barrels, (leaving 19,941,846,000 barrels of crude oil only) and as of December 31, 1944 there were 668,701,000 barrels included. Beginning with this report the figures in this table are for crude oil only. If comparison is made between new oil reported in 1946 with new reported in earlier years, it should be remembered that the 1946 figures for new oil do not include new condensate which is estimated to be approximately 205,000,000 barrels.

Table 1

(Barrels of 42 U. S. Gallons)

Total proved reserves of crude oil (exclusive of 884,967,000 bbl of condensate) as of December 31, 1945		19,941,846,000
Revisions of previous estimates	+1,254,705,000	
Extensions of old pools	1,158,923,000	
New reserves (new pools) discovered in 1946	244,434,000	2,658,062,000
Total proved reserves as of December 31, 1945 and new proved reserves added in 1946		22,599,908,000
Subtract production during 1946		1,726,348,000
Total proved reserves of crude oil as of December 31, 1946		20,873,560,000
Increase in crude reserves since December 31, 1945		931,714,000

putation shows additions of 2,658,062,000 barrels during 1946, of which 1,254,705,000 represented revisions of previous estimates, 1,158,923,000 extensions of old pools, and 244,434,000 discoveries during the year. Deducting the year's production of 1,726,348,000 barrels leaves a total of 20,873,560,000 barrels as of December 31, 1946, a net gain of 931,714,000 or approximately 4.7 percent.

Including reserves of condensate and other natural gas liquids, the total at the end of 1946 is 24,194,587,000 barrels, an increase of 16 percent. The report of the reserves committee of the American Gas Association places proved natural gas reserves on December 31, 1946, at 160.6 trillion cubic feet, an increase of 12.8 trillion cubic feet or roundly eight percent over the total of 147.8 trillion feet reported for December 31, 1945.

A summary of the production record of the oil industry in 1946 as estimated by the API committee on reserves is given in Table 1. In this report as in all previous ones the committee has included only proved reserves recoverable under existing economic methods.

"Proved reserves are both drilled and undrilled. The proved drilled reserves, in any pool, include the oil estimated to be recoverable by the production systems now in operation, whether primary or secondary, and from the area actually

Table 2

Estimated Proved Reserves in the United States

(Thousands of Barrels of 42 U. S. Gallons)

STATES	Estimates Proved Reserves Crude Oil Plus Condensate (Dec. 31, 1945) as shown in Committee's Report of February, 1946	PROVED RESERVES OF CRUDE OIL—(Condensate not Included)				
		Proved Reserves as of Dec. 31, 1945	Changes in Proved Reserves Due to Extensions (New Oil) and Revisions in 1946	Proved Reserves in New Pools Discovered in 1946*	Production During 1946	Proved Reserves as of Dec. 31, 1946 (Columns 2+3+4 Less Column 5)
	(1)	(2)	(3)	(4)	(5)	(6)
Alabama	785	785	109		382	512
Arkansas	303,674	287,623	4,172	1,764	26,501	267,058
California	3,409,948	3,318,006	276,787	13,876	315,178	3,293,491
Colorado	259,830	259,830	51,265	800	12,025	299,870
Illinois	349,620	349,620	72,452	4,606	75,414	351,264
Indiana	41,243	41,243	7,878	1,633	6,684	44,070
Kansas	541,846	541,846	87,319	12,629	96,478	545,316
Kentucky	56,721	56,721	13,066	88	10,687	59,188
Louisiana	1,689,781	1,558,891	207,018	25,857	139,969	1,651,797
Michigan	64,186	64,186	21,576	415	17,000	69,177
Mississippi	267,160	257,363	34,939	1,790	23,871	270,221
Montana	108,474	108,474	2,576	2,000	8,804	104,246
Nebraska	500	500	665	.....	290	875
New Mexico	512,373	512,373	65,000	2,871	36,791	543,453
New York	81,189	81,189	.....	.....	4,900	76,289
Ohio	29,681	29,681	3,047	.....	3,508	29,220
Oklahoma	889,839	888,839	98,423	47,731	136,807	898,186
Pennsylvania	110,601	110,601	.....	.....	13,100	97,501
Texas	11,470,294	10,835,257	1,441,158	126,594	756,649	11,646,360
West Virginia	38,630	38,630	.....	.....	2,975	35,655
Wyoming	600,131	599,881	25,919	1,780	38,222	589,358
Miscellaneous†	307	307	259	.....	113	453
Total U. S.	20,826,813	19,941,846	2,413,628	244,434	1,726,348	20,873,560

* Only a limited area is assigned to each new discovery even though the committee may believe that eventually a much larger area will produce, for in this report the concern is only with actually proved reserves.
† Includes Florida, Missouri, Tennessee, Utah and Virginia.

Table 4

Estimated Proved Recoverable Reserves of Natural Gas in the United States

(Millions of Cubic Feet)

	RESERVES AS OF DEC. 31, 1945	CHANGES IN RESERVES DURING 1946			RESERVES AS OF DECEMBER 31, 1946			
		Discoveries, Extensions and Revisions	Net Production	Net Increase	TOTAL	Non-associated	Associated	Dissolved
Alabama	23	75	1	74	97	0	0	97
Arkansas	869,686	54,171	52,195	1,976	871,662	447,651	162,276	261,735
California	10,855,707	803,056	532,462	270,594	11,126,301	3,687,430	3,198,714	4,240,157
Colorado	396,282	(-) 70,905	9,614	(-) 80,519	315,763	155,440	41,075	119,248
Illinois	268,000	33,500	33,500	0	268,000	3,000	55,000	210,000
Indiana	17,000	3,200	3,200	0	17,000	4,000	8,000	5,000
Kansas	13,250,605	636,771	206,532	430,239	13,680,844	13,257,617	212,310	210,917
Kentucky	1,436,800	44,200	95,000	(-) 50,800	1,386,000	1,299,000	0	87,000
Louisiana	19,849,393	3,170,050	607,932	2,562,118	22,411,511	18,323,314	2,697,126	1,391,071
Michigan	8,931	148,069	26,000	122,069	131,000	76,200	0	54,800
Mississippi	2,007,859	383,842	21,188	362,654	2,370,513	1,731,821	446,098	192,594
Montana	1,202,521	(-) 319,521	29,599	(-) 349,120	853,401	853,401	0	0
Nebraska	375	(-) 374	0	(-) 374	1	0	0	1
New Mexico	5,190,309	899,737	185,260	714,477	5,904,786	3,079,900	2,132,911	691,975
New York	76,000	900	7,000	(-) 6,100	69,900	69,000	0	900
Ohio	626,800	46,200	59,000	(-) 12,800	614,000	573,000	0	41,000
Oklahoma	10,079,938	1,311,816	*655,908	655,908	10,735,845	7,572,279	1,589,538	1,574,028
Pennsylvania	520,000	61,000	78,000	(-) 17,000	503,000	453,000	0	50,000
Texas	78,306,676	10,154,021	2,097,238	8,056,783	86,363,459	62,345,192	15,282,025	8,736,242
West Virginia	1,928,300	116,700	205,000	(-) 88,300	1,840,000	1,739,000	0	101,000
Wyoming	816,763	252,379	33,545	218,834	1,035,597	692,191	235,176	107,230
Miscellaneous*	81,399	265	4,443	(-) 4,178	77,221	76,900	0	321
TOTAL	147,789,367	17,729,152	4,942,617	12,786,535	160,575,901	116,440,336	26,060,249	18,075,316

* Includes Florida, Missouri and Utah.
Notes: Volumes are reported at a pressure base of 14.65 pounds per square inch absolute, and at a standard temperature of 60°F.
Net production equals estimated gross withdrawals, less gas reinjected into underground reservoirs.
Reserves of *dissolved* gas were estimated jointly with the A.P.I. Committee on Petroleum Reserves.

Table 5

Estimated Proved Recoverable Reserves of Natural Gas Liquids in the United States as of December 31, 1946

(Thousands of Barrels)

RESERVES AS OF DECEMBER 31, 1946

	Non-associated	Associated	Dissolved	TOTAL	1946 Production
Arkansas	41,071	8,306	12,223	61,600	3,457
California	40,328	107,300	160,644	308,272	21,885
Colorado	775	410	1,192	2,377	200
Illinois	—	—	34,200[a][d]	34,200[d]	3,900
Indiana	—	—	85[a]	85	16
Kansas	80,202	1,140	1,150	82,492	1,991
Kentucky	16,071[a]	—	—	16,071	1,310
Louisiana	330,466	75,019	13,911	419,396	13,500
Michigan	—	—	655[a]	655	309
Mississippi	17,212	34,095	192,594	243,901	108
Montana	8,534	0	0	8,534	108
New Mexico	27,697	30,950	14,962	73,609	2,818
Ohio	1,714[a]	—	—	1,714	143
Oklahoma	45,597	10,020	12,700	68,317	9,875
Pennsylvania	2,309[a]	—	—	2,309	262
Texas	1,292,177	296,072	397,357	1,985,606	66,134
West Virginia	19,285[a]	—	—	19,285	2,400
Wyoming	458	9,400	15,600	25,458	846
Miscellaneous[c]	—	—	6[a]	6	—
TOTAL	1,923,896[b]	572,712[b]	857,279[d][b]	3,353,887[d]	129,262

[a] Not allocable by types, but occurring principally in the column shown.
[b] Approximate total; see footnote [a].
[c] Includes Alabama, Florida, New York and Utah.
[d] Figure revised March 11, 1947.

drilled up on the spacing pattern in vogue in that pool. The proved undrilled reserves, in any pool, include reserves under undrilled spacing units which are so close, and so related to the drilled units, that there is every reasonable probability that they will produce when drilled.

"In the case of new discoveries, which are seldom fully developed in the first year and in fact for several years thereafter, the estimates of proved reserves necessarily represent but a part of the reserves which may ultimately be assigned to the new reservoirs discovered each year. For a one-well field, where development has not yet gone beyond the discovery well, the area assigned as proved is usually small in regions of complex geological conditions, but may be larger where the geology is relatively simple. In a sparsely drilled field the area between wells is considered to be proved only if the information regarding the geology of the field and the productive horizon is adequate to assure that such area will produce when drilled. The total of new oil through discoveries estimated as proved in any given year is comparatively small and the total of new oil through extensions is comparatively large. As knowledge of the factors affecting production and well performance become available, and as these factors are studied, reserves in older fields can be estimated with greater precision and revised accordingly. Therefore, the oil assigned to new discoveries, plus the oil proved through extensions, comprises the total quantity of the new proved reserves for the year."

The committee stressed the fact that its "estimates of proved reserves cannot be used as a measure of the rate at which these reserves can be produced with or without physical waste. Oil cannot be produced from the permeable rocks in which it occurs at any desired rate, because the flow of oil through the pores of the oil-bearing rocks is definitely controlled by the physical factors of the reservoir. As a matter of fact, today's known oil can be recovered only over a period of many years and at gradually declining annual rates. This has been widely demonstrated by past performance under all kinds of operating conditions. Therefore, only incorrect conclusions as to the life of these estimated reserves can be obtained by dividing these reserves by the current rate of production."

Table 2 was prepared by the API committee to permit comparison of last year's reserves with previous reports in which cycle and lease condensate liquids were included with crude oil. Table 3 is a summary tabulation of the API committee's reports by years since 1937.

Members of the API committee presenting the report are: F. H. Lahee, chairman, Sun Oil Co.; G. Clark Gester, vice chairman, Standard Oil Co., of Calif.; Fred Van Covern, secretary, American Petroleum Institute; R. F. Baker, The Texas Co.; L. T. Barrow, Humble Oil & Refining Co.; D. V. Carter, Magnolia Petroleum Co.; Frank R. Clark, The Ohio Oil Co.; Alexander Deussen, Consulting Geologist; J. M. Sands, Phillips Petroleum Co.; Theron Masson, Pure Oil Co.; Fred E. Wood, Standard Oil Co., (Ind).

The AGA committee estimated that the proved recoverable reserves of natural gas in the United States as of Dec. 31, 1946 approximated 160 trillion cubic feet, classified as follows:

	Trillions cu. ft.
Non-associated gas (free gas not in contact with crude oil in the reservoir)	116
Associated gas (free gas in contact with crude oil in the reservoir)	26
Dissolved gas (gas in solution in crude oil in the reservoir)	18

All volumes were calculated at a pressure base of 14.65 psi absolute, and at a temperature of 60°F. The estimate is detailed by states in Table 4. The increase over the Committee's previous estimate for Dec. 31, 1945 is accounted for as follows:

	Trillions cu. ft.	
Total proved reserves as of December 31, 1945		148
Revisions, extensions and discoveries, 1946	17	
Less production during 1946	5	
Net increase in reserves during 1946		12
Estimated proved reserves as of December 31, 1946		160

Both committees now use the term "natural gas liquids" to describe those hydrocarbon liquids that are gaseous in the reservoir but are obtainable by condensation or absorption. Natural gasoline, condensate, and liquefied petroleum gases fall in this category. The proved recoverable reserves of natural gas liquids in the United States are estimated, as of Dec. 31, 1946 to be 3,354 million barrels. These reserves are classified in the same manner as the gas from which they are extracted, as detailed in Table II and summarized below:

	Million Bbls.
Non-associated	1,924
Associated	573
Dissolved	857

Members of the AGA committee are: N. C. McGowen, chairman, United Gas Corp.: Lyon F. Terry, vice chairman, Chase National Bank; R. M. Bauer, Southern California Gas Co.; R. O. Garret, Arkansas Louisiana Gas Co.; Charles C. Hoffman, Cities Service Gas Co.; Frederick S. Lott, Bureau of Mines; W. T. Nightingale, Mountain Fuel Supply Co.; Perry Olcott, Humble Oil and Refining Co.; E. E. Roth, Columbia Engineering Corp.; Walter E. Caine, secretary, American Gas Association.

Men, Oil and War

"Men, Oil, and War," a 360-page-book telling the story of the work oil men of the Midwest did to help win the war, is off the press according to an announcement by O. D. Donnell, president of the Ohio Oil Co. who served as chairman of the industry's general committee for District Two. Copies of the book are being distributed to committee members, the press, libraries, oil industry leaders and representatives of federal and state governments.

The book originated with a request from the government for a report which might serve as a guide in any future emergency and cut short the time needed to organize the production and supplying of oil products. The author is D. Thomas Curtin who has written graphic description of the industry's performance in fiteen midwestern states. The book tells how all forms of transportation were used to maximum capacity, how refineries were adjusted to war requirements, and how many diverse interest and personalities were united in a smoothly operating machine.

OGD FINDING ITS PLACE IN GOVERNMENT SET-UP

By WILLIAM J. MADDOX

Chief, World Petroleum's Washington Bureau

OGD Director Max Ball has made it clear that his agency not only has no power to direct the industry or anyone in it, but that, what's more, it doesn't want such power and should not have it except in times of national emergency. Ball also has gone a long way toward quieting the apprehension of other government agencies that have dealings with the oil industry that their activities might be taken over or at least directed by the newly-created OGD.

He was particularly emphatic in clearing up these misgivings in his talk March 8 before the North Texas Oil and Gas Association at Wichita Falls. As for the relations of OGD with the industry, the director said:

"At present, it is true, the Division enforces the Connolly Hot Oil Act, by which the federal government tries to see that state conservation laws are not violated. At some future time, for all I know, the government may be called upon to assist further or in other ways in enforcing or supplementing state actions. Whether the enforcement of such future laws, if there should be any, will fall to the Oil and Gas Division I do not know. In my dreams for the Division's future, operational activities play at best a minor part, overshadowed if not obliterated by staff functions such as advising, coordinating and supervising. In any case federal acts supplementing state laws do not, by any definition, constitute steps toward government control of the industry.

"I do not believe in government control of private industry, beyond seeing that the game is played fairly according to the rules. I do not believe in a planned economy. I believe in an economy shaped from day to day and from year to year by production for profit under free and competitive conditions. I believe in the economic system that has reached its highest development to date in the United States of America."

As to wrapping into one package all the government functions relating to oil and gas, as some have feared was intended in the creation of OGD, Ball believes this would violate all the rules of sound organization; it would be unsound, impracticable and unwise.

Some centralization of the government's activities in oil and gas, however, Ball believes desirable. In reference to the survey that OGD now is making to find out what those activities are and by whom and how they are carried on, he says it has proved more of a task than appeared at first glance. Already, however, it shows that nearly 40 bureaus or divisions or independent units carry on activities that may affect either the industry or government action or policy. Most of these activities started where they are with good reason, and in most cases, he suspects, the reason still holds good.

The long-smouldering resentment of the independent producers of natural gas and oil against what they consider the unlawful extension of its authority by the Federal Power Commission got Congressional recognition in a small flock of bills that are aimed to keep the commission "on the beam." Fears have been expressed in the oil industry for some years that the Commission by stepping over the line in its regulation of natural gas would find a basis for extending its authority to include the production of oil. The bills are similar in scope and are amendments to the Natural Gas Act to clear up any possible doubts as to the authority of FPC and confining its activities to interstate business only. All question of regulation of oil production is removed.

Three of the bills were introduced in the House, one by Representative Ross Rizley of Oklahoma (H. R. 2185) and the others by Representatives Carson of Ohio and Davis of Tennessee. On the Senate side, Senator E. H. Moore, of Oklahoma, introduced S. 734 on behalf of himself and Senator Homer Ferguson of Michigan. They were referred to the Interstate and Foreign Committees of the respective bodies.

Among other things the amendment would specifically forbid the FPC from assuming jurisdiction over the "end use" of gas. Coal and railroad interests for years have urged the Commission to take this authority. According to Rizley, Congress did not intend this and there is no reason why any agency should seek to prevent a consumer, who is willing to pay for a commodity, from using it in whatever manner best suits his needs. FPC also would be forbidden to assume jurisdiction over sales of natural gas made directly to industrial plants by either interstate pipe lines or by local distributors. Such sales were specifically left outside the jurisdiction of FPC in the Natural Gas Act, but the Commission has been accused of seeking to take this authority by indirect methods.

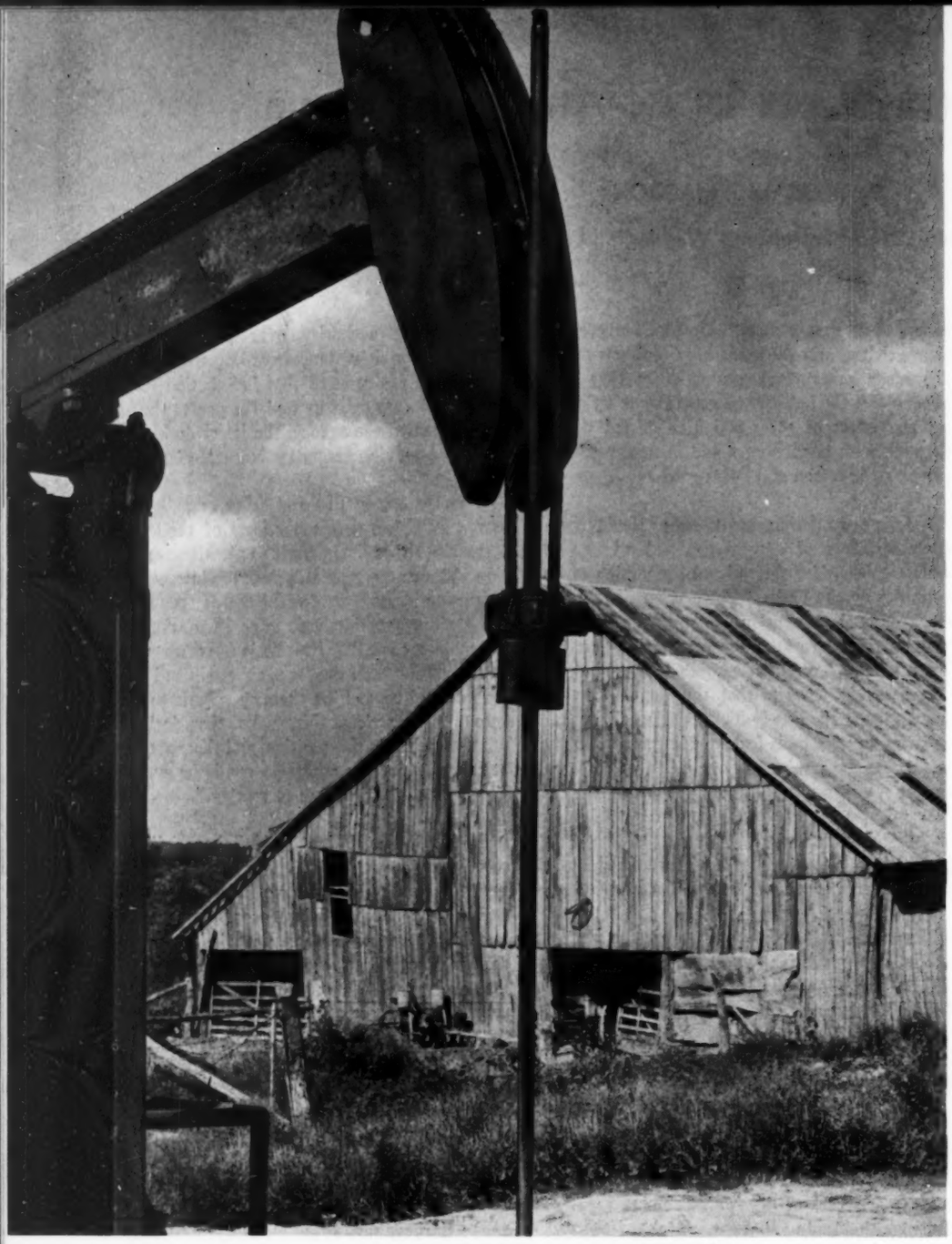
Of major importance to the oil industry as well as the gas industry is the provision in the Rizley measure to exclude FPC from jurisdiction over the production and gathering of natural gas. Congress, in the Natural Gas Act, prohibited FPC from having authority over production and gathering activities, but, according to critics the commission has asserted that jurisdiction for the purpose of rate making, and the courts thus far have sustained the agency, the latest decision being that involving Interstate Natural Gas Co.

"By its actions in this and other cases," Rizley says, "FPC has defeated efforts of the various states and the industry itself to practice conservation, because companies primarily interested in producing oil now are fearful that if they should sell their gas to interstate pipe lines, they will be subject to FPC jurisdiction, which would mean limiting their profits to six or six and a half percent and compelling them to submit to FPC accounting practices. Naturally, they decline to put themselves in this position, and there are large amounts of gas that otherwise would be available that are not now getting to market."

NPC Chairman Walter S. Hallanan, following the January meeting of the Council, has been rapidly rounding out the working units of the government-industry liaison organization. During the past month he has selected the personnel that will constitute seven of the major committees authorized at the January meeting of the council. Here are the committees and their respective chairmen:

Tanker Transportation, J. P. Patterson, Pan American Petroleum and Transport Company; Truck Transportation, Lee R. Cowles, Standard Oil Company (Indiana); Temporary Committee on Military Aircraft Fuels Productive Capacity, Bruce K. Brown, Standard Oil Company (Indiana); Barge Transportation, Harry H. Gilbert, Oil Transfer Corporation; Pipeline Transportation, B. I. Graves, Tide Water Associated Oil Company; International Standards for Measurement of Liquid Petroleum Fuels, W. W. White, Intava, Inc.; Rail Transportation, Fayette B. Dow, National Petroleum Association.

OGD now has a full-time consultant on organization. He is Bradley Murray of Tulsa, Okla., former official of the Danciger Oil and Refining Company. He has been an organization specialist in government agencies and member of the American financial mission to Iran. During the war Bradley served on the organizational planning staff of PAW, and his experience there well qualifies him to guide its successor in organizational and administrative matters, including relationships with other federal agencies, with state bodies and with the industry, as well as in its internal organizations and procedure.



Carter Oil Co. pumping well on an Illinois farm.

SECONDARY RECOVERY METHODS

By DR. O. W. WILLCOX

INTEREST in secondary recovery of oil from reservoirs that have become or are becoming depleted because of failure of natural flow is greater today than ever before.

Although previously practised on a large scale, interest in secondary recovery became intensified during World War II when the need for more oil was so great. This interest was not greatly diminished when military demands slackened; the demand for oil for civil use was still large, and at the same time new reserves were not being discovered in satisfactory volume in spite of greater activity in prospecting and exploratory drilling.

The field that lies open for the application of secondary recovery is shown by the survey of stripper wells that has been completed by the National Stripper Well Association and the Interstate Oil Compact Commission for 1945. A stripper well is defined as an oil well that has passed its period of flush production and is now yielding oil at so low a rate that the expense of operation is about equal to the income derived from it. There may still be large quantities of oil left in the oil sand, but it will no longer move of itself to the wellhole from which it may be pumped. The process of applying artificial means to make the residual oil move is called secondary recovery.

In the course of time every oil well becomes a stripper, and the number of strippers tends to become equal to the wells that have not attained stripper age. As of January 1, 1946, there were a total of 421,447 producing oil wells in the United States, and of these, 299,146 or 71 percent were classed as strippers, including 2,758 strippers more than in 1944. In 1945 these stripper wells contributed 13.5 percent of the total oil production of the United States. The average daily production per stripper was 2.1 barrels.

It is estimated that the stripper well acreage in 1945 was 3,104,416 acres, or 46 percent of the total oil acreage of the United States. During that year 9,103 stripper wells were abandoned as no longer profitable, in spite of the subsidy paid by the federal government in order to prolong their operation. These 9,103 strippers abandoned in 1945 are estimated to contain a total of 18,626,927 barrels of oil that might be recovered by an adequate system of secondary recovery.

How long a stripper well remains in operation depends on the price of oil (including any subsidy paid by the government). Calculations have been made to show how much more oil the strippers would produce under natural flow if the price of oil should increase over present levels as follows:

Increase of Price per Bbl.	Estimated Increased Stripper Production
25 cents	335,169,050 bbl.
50 cents	1,255,666,241 bbl.
75 cents	1,825,277,669 bbl.

Still, even with the highest price that is likely to be obtained, there eventually comes a time when no stripper well will pay for continued operation. It is generally recognized that, on the whole, more than half the original content of oil reservoirs remains in the sand after the force of the natural drive which brings the oil within reach of the pump has been exhausted. Only secondary recovery will help in recovering a part of the remainder.

The accompanying table shows the number of stripper oil wells in the United States as of

January 1, 1946, their production in 1945, and the number of wells abandoned in the various states.

Current opinion is that there are at least three billion barrels of oil reserves contained in fields that have been abandoned or are near abandonment which can be recovered only by secondary methods.

The 1945 stripper well survey has shown that oil operators are more and more ready for efforts to develop these residual reserves. A study of secondary recovery possibilities is under way in Arkansas, where 50,000,000 barrels are believed to be recoverable, particularly if the present price should rise. In California a reported estimate of 528,000,000 barrels would be recoverable if the price were increased 50 cents. States in which secondary recovery projects are now in operation, in some cases on a large scale, include Illinois, Kansas, Kentucky, Missouri, New York, Ohio, Oklahoma, Pennsylvania and Texas. Projects for secondary recovery are said to be under way or under consideration in Louisiana and West Virginia. This interest in secondary recovery would greatly increase if the subsidy should be restored or if the price should increase.

Second Recovery by Water Drive

Both of the two principal methods of secondary recovery—by artificial gas drive and by artificial water drive—are in growing use. The choice between them is dictated by circumstances, principally of an economic nature. When all surrounding conditions are otherwise equal, the choice is generally given to artificial water drive, principally because this method results in a higher final recovery.

Both methods made their appearance in petroleum technology at a relatively early date in oil history. At first the gas drive took the lead, as it is simpler and requires a smaller original investment; the chief defect of this method is that channelling and by-passing are likely to occur; many gas drives ended up by leaving considerable residual oil in the sands which it was later found could be recovered by the more thorough sweep of a water drive. This has been the history of many secondary recovery projects in the Mid-Continent: When natural flow failed, a gas (or air) drive was instituted; when that ceased to be effective, successful recovery could be continued by a water drive.

The early history of the artificial water drive is somewhat obscure. Attention was attracted to its possibilities by accidental floods, due to invasion of old and nearly exhausted oil wells by water from leaky casing or other sources, followed by a greatly increased production. A number of operators took the hint and flooded their oil wells with varying success. Public opinion of the oil industry frowned on the practice as likely to be damaging to good oil properties, but it was continued in secrecy.

The water-flood was first given a status of legitimacy by the legislature of Pennsylvania in 1921, and from that time on, the method developed in full publicity. The Pennsylvania operators, particularly in the Bradford region, developed the method with success.

From Pennsylvania the practice spread in various directions and has become well established in the central states and the Mid-Continent, especially in Illinois, Kansas, Oklahoma and Texas. Operators in these areas were at first guided by experience in Pennsylvania which, on account of differing conditions, did not always bring success.

Organized water flooding in Oklahoma began in 1931, and while this first project was not on the whole an outstanding success, it continued for a long time and convincingly demonstrated the feasibility of the idea. By 1942, 38 companies and individuals were granted licenses for water floods in this state.

The Kansas legislature legitimized the practice in 1935. Systematic flooding operations were started, and by 1944 numerous going projects had been established in 13 counties.

In Illinois water flooding of oil sands dates back to 1933, but the first project produced no striking result. Some years later an accidental flood gave remarkable results, but the Illinois operators did not get around to systematic flooding until a few years ago. In this state a systematic application of water flooding was first made on a limestone reservoir (the McClosky oolite).

In Texas water flooding was legitimized late in 1935 by the Texas Railroad Commission and has since been practiced mainly in the north-central part of the state, which includes old shallow fields in eight counties. Near the close of World War II, there were 33 active and five abandoned projects in this area.

On its technologic and engineering sides, the practice of water flooding has settled down into a more or less standardized routine. The first stage is planning and preparation, involving lessons that had to be learned the hard way.

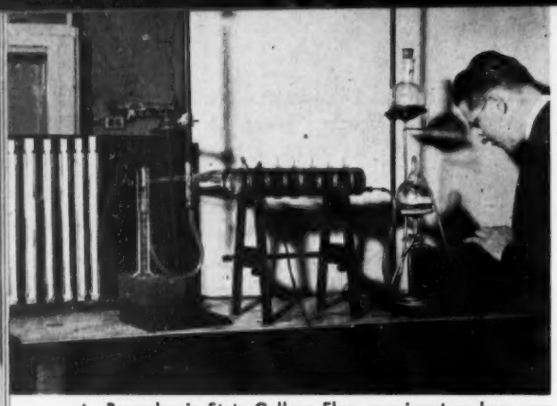
As everywhere else, in the Mid-Continent successful flooding depends on accurate prior knowledge of underground conditions, especially the amount of residual oil which the reservoir may contain and the porosity and permeability of the oil-containing beds. Nowadays, most newly-discovered oil fields are being developed with an eye to the eventual use of secondary recovery after the first period of flush production and natural flow is over. The various oil sands are carefully cored and electrically logged for information which not only facilitates primary

Stekoll Oil Co. water injection plant at Independence, Kan. Caterpillar Tractor photo.

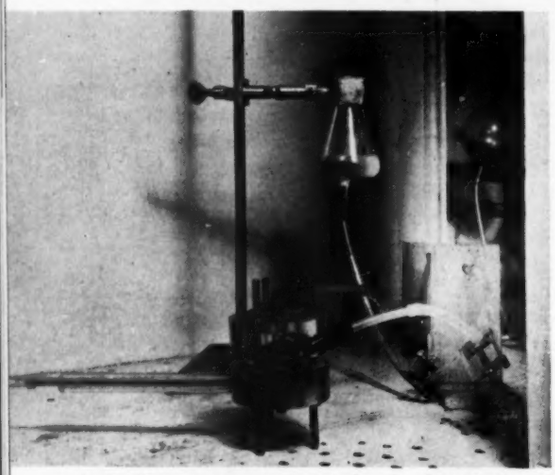
Drilling is active in Western Pennsylvania because of Secondary Recovery operations.

STRIPPER WELLS IN THE UNITED STATES

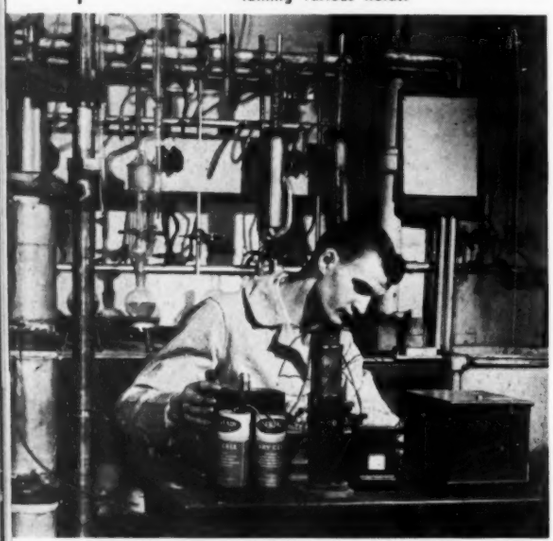
State	Number of Wells 1945	Annual Production 1945	Abandonments 1945
Arkansas	2,539	5,846,770	56
California	10,000	29,200,000	307
Colorado	95	140,600	None
Illinois	15,350	6,590,000	634
Indiana	1,480	444,000	125
Kansas	17,012	29,293,000	525
Kentucky	13,714	4,250,000	200
Louisiana	2,811	7,863,192	250
Michigan	2,941	6,445,247	164
Mississippi	52	234,928	26
Missouri	43	37,715	None
Montana	1,985	2,659,709	55
Nebraska	70	305,000	3
New Mexico	1,100	2,400,000	2
New York	21,300	4,527,852	424
Ohio	22,247	2,054,408	471
Oklahoma	49,124	71,168,080	735
Pennsylvania	83,000	12,515,000	2,500
Tennessee	19	6,662	1
Texas	35,000	38,225,000	2,515
West Virginia	17,230	2,879,000	104
Wyoming	1,984	3,602,541	6
TOTAL U.S.	299,146	230,688,764	9,103



Pennsylvania State College Flow experiment on long core for determination of capillary pressure versus saturation data on cores containing various fluids.

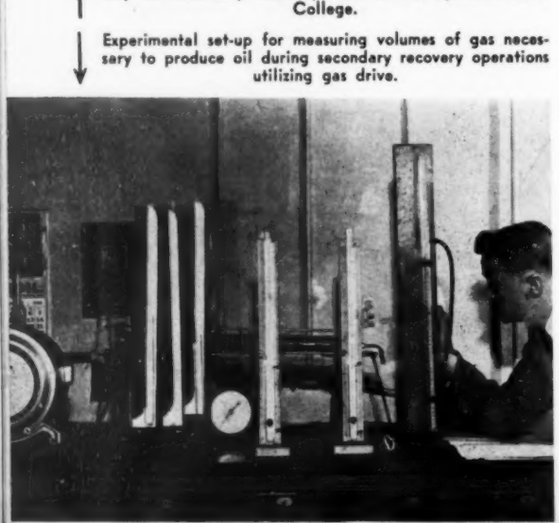


Capillary pressure equipment for the determination of capillary pressure versus saturation data on cores containing various fluids.



Equipment for mounting large cores in plastic preparatory to secondary recovery tests at Pennsylvania State College.

Experimental set-up for measuring volumes of gas necessary to produce oil during secondary recovery operations utilizing gas drive.



production but is of great value when the time for secondary recovery arrives.

This wise forethought was largely absent in the not-so-remote history of the oil industry, and this has been true of the numerous Mid-Continent fields where the coring data, much needed for secondary recovery, is absent, and this circumstance adds considerably to the risk of the projects unless a more or less expensive coring survey is made.

Spacing for Secondary Recovery Wells

The economics of a water-flood are largely dependent on a rational spacing of the wells from which the oil is to be taken and the wells which are to be used for introducing the flood-water into the oil sands; here again the errors made during the prior development period make secondary recovery operations difficult. Much of the original drilling was done on an irregular spacing pattern, which had to be corrected in many cases by putting down new holes.

For the sake of economy, many operators use existing wells exclusively, without regard to pattern. Others drill new water-injection wells but use old producing wells, and on some projects new producing wells are drilled. Wherever possible, in spacing the wells, a five-spot arrangement is used, that is, four producing wells are spaced in the form of a square, with an input well in the center of the square. This does not mean that in the whole field there is only one input well to four producing wells, because across the field a line of producers is enclosed between two lines of inputs, or vice versa, so that in the end there is, on the whole, approximately one input well for every producing well. In some cases where the wells had been drilled on regular 300-foot locations, a nine-spot pattern has been used, where the center well of each nine is converted into an input well. Experience with this arrangement in North Texas indicates that in comparison with a five-spot pattern on adjacent projects, the nine-spot project responded much more slowly to water injection and did not reach the peak of production for more than two and a half years.

On projects developed with an irregular pattern, an attempt is usually made to take advantage of natural drainage and the proximity of producing wells in determining which wells are to be converted to water-injection wells. Lack of such consideration may be a large factor in the failure of water-flooding projects.

In the shoestring oil fields of Kansas, the five-spot pattern is generally followed at distances of 330 feet, but the tendency is to space the wells closer across the narrow directions of the field than in the other direction, such as 300-600 feet, or 400-700 feet. The distances between like wells usually is figured with some relation to the depth of the oil sand. Thus, in shallow Kansas fields, the spacing in regular patterns may be 300 feet; where the oil sand is down about 2,000 feet, like wells may be spaced 600 or more feet apart. Kansas operators who have used 660-foot spacing on deep sands, or one input well to 10 acres, have proved that wide spacing compensates for the greater cost of deep drilling where the sand characteristics are favorable. In such cases increasing the distance between the wells reduces the costs of development and lengthens the time of operating the project, which usually means deferment of the pay-out.

From this it appears that the spacing problem is intimately connected with field characteristics and economic considerations, and involves a nice balancing of circumstances to obtain the largest ultimate profit.

In Oklahoma the spacing in systematically developed water-flooding projects on the oil-bearing Bartlesville sand (which lies at depths of from 350 to 750 feet), is 330 feet, although there are a few where the spacing is 440 feet, particularly where the oil sand lies at depths of more than 700 feet. Here again the wider spacing is invoked to compensate higher drilling costs. In spite of this wider spacing, the projects at depths of 700 to 1,000 feet have been among the most successful in Oklahoma, which may be due to special circumstances.

In some areas where the permeability of the oil sand is higher in one direction than in the other, like wells are spaced 330 feet in the direction of low permeability and 440 feet in the direction of high permeability.

In laying out a pattern for a water-flooding project, most operators ignore the location of old wells which either are permitted to produce oil until they are "watered out" or are plugged when the development is begun. Occasionally an old well that happens to fit closely into the proposed well-spacing pattern will be reconditioned and used as a producing oil well but seldom as a water-intake well, as most operators agree that an old well does not make a satisfactory water-intake well. As might be expected, a number of small water-flooding projects are operated by individuals who are not financially able to drill all new wells on their properties. These operators adopt no definite well-spacing pattern but use some of the old oil wells (which seldom are uniformly spaced) as water-intake wells, or they drill a few new wells among the old producers to serve as intake wells. From the standpoint of oil recovery the results attained usually have been unsatisfactory.

Many operators financially able to develop their water-flooding projects as units use what is known as the "delayed-drilling" principle; that is, the intake wells are drilled first, and water is forced through them into the sand for two to six months before the oil wells are drilled. This method of developing a water-flooding project is especially desirable if there are wide variations in the permeability of the sand, because once the voids in the more permeable part

of the sand are filled with fluid after the oil has been driven toward the center of the pattern, water can be forced into the less permeable strata to move the contained oil nearer the producing well locations more effectively before they are drilled.

Well-Completing Methods

Most of the oil-producing wells found on North Texas water-flooding projects have been completed with casing of various sizes, ranging from 4½ to eight inches, set and cemented at the top of the sand. Two-inch tubing commonly is used for the pumping string in producing wells.

Water-injection wells usually are completed similarly to the producing wells, although in some projects they are completed with a 4-inch perforated liner in the sand and a string of 2-inch tubing in the open hole with a packer set and cemented at the top of the sand.

On one lease flooding three different sands, the water-injection wells are completed so that one well may be used for flooding all three sands by the use of separate strings of various sizes of tubing and multiple packers.

The oil-producing sands in this area are so permeable that seldom is it considered necessary to shoot the sand in either producing or injection wells.

In Kansas most operators do not case their input wells. The common practice is to complete them with one joint of surface casing, and equip them with a string of tubing supported on a tubing packer at the top of the sand. Another practice frequently used in the shallow sands is to complete both water-input and oil-producing wells without casing and to equip them with tubing and packers as just described for input wells. Phillips Petroleum Co., on the other hand, cased both the producing and input wells on their projects in Greenwood County, where the Bartlesville sandstone lies at a depth of about 2,000 feet.

Where more than one oil-producing formation is penetrated, one practice has been to flood the lowest zone first, following which the upper zones are flooded in succession after plugging back and perforating the casing. A few operators, however, complete their wells in a manner that permits flooding two or three zones simultaneously under separate control. The Kirby Oil Co., for example, completed the input wells in three sandstones (Squirrel, Prue and Bartlesville) as follows: The well was drilled through the three sandstones to the bottom of the Bartlesville (lower) sand and cased with 4-⅞-inch pipe down to the top of the Squirrel (upper) sand and cemented. Two strings of tubing then were run into the well. One string consists of 1-inch tubing connected above 79 feet of 2-inch-diameter tubing with packer on its lower end, set at the top of the Bartlesville sand (567) feet and cemented back to the bottom of the Prue (middle) sand at 505 feet; the other string is 2-inch-diameter tubing, with packer on end, which was run over the 1-inch tubing to the 1-by-2-inch pipe collar (junction of the 1- and 2-inch pipes) in the first string at the top of the Prue sand (488 feet). The packer on the end of the 2-inch string was then set at the top of the Prue sand, and the 2-inch string was cemented from the packer back to the bottom of the Squirrel (352 feet). The lower end of the 2-inch string of tubing, resting upon the shoulder of the 1-by-2-inch pipe collar, projects slightly below the packer and is slotted to permit passage for the water. By this arrangement of casing and tubing strings in the input well, water injected into the Bartlesville sand passes down through the combination string (1-inch pipe with 79 feet of 2-inch pipe on lower end), water to the Prue sand passes down through the annular space between the 1-inch and 2-inch strings, and water to the Squirrel sand passes down through the annular space between the 3-inch tubing string and the 4-⅞-inch casing. Another operator is experimenting with parallel strings of tubing in input wells so as to flood two sands simultaneously.

The completion practices in Oklahoma are similar to those in other Mid-Continent areas. In a majority of all cases, the overall savings resulting from completing wells without casing have been considerable. The Oklahoma operators are more inclined to shoot newly-drilled input and producing wells with nitroglycerine than are operators in the above-mentioned states, due to small average porosity of the sands.

Production Practice

After the wells have been prepared for secondary recovery by water floods in the Mid-Continent, the practical operation of recovery is more or less standardized, although there are many variations imposed by local conditions which require special engineering.

In all cases a major requirement for successful water-flooding operations is an adequate supply of suitable water. Operators who rely upon waters from streams and ponds are constantly faced with shortages of supply in dry seasons and during rainy seasons with water that requires extensive treatment to make it suitable for use in water flooding, and the treatment of water for injection purposes must be varied to meet conditions. Fresh waters usually contain organic matters in suspension, and the growth of the algae must be prevented with chloride of lime and copper sulfate before the water is suitable for injection purposes. If such water is not treated, the organic matter will accumulate on the face of the sand in input wells and reduce their intake capacities. Brines, on the other hand, usually are adequate for flooding, though some of them may have to be treated to remove hydrogen sulfide and to stabilize dissolved constituents; the particular treatment required for a brine before injection usually need not be altered once it has been developed.

After treatment the injection water has to be passed through filters, of which there are two types. In the open-type system, water is pumped from the treating tank through filters into a clear-well tank and then is pumped to the input wells. Many operators use a system of two cylindrical filters filled with graded sand and anthracite coal.

Some operators use the closed-type of water treatment, in which the raw water is pumped into a storage tank, where contact with air is prevented by maintaining an oil seal on the surface of the water in the tank. In this type a pressure filter is commonly used.

In a water-flooding project the oil may be produced either by removing it from the bottom of the well by means of a pump, or by applying sufficient pressure to cause the oil (with some water) to flow out at the surface; in that case there is no need for pumping equipment and tubing. The pressure on the injection water, however, must be controlled, because the pressure that can be applied safely to a formation to cause wells to flow is limited by the weight of the overburden on the oil-producing formation. Excessive injection pressures cause "breaks" in the oil-producing formation, and the water may channel from input to producing well without moving the desired quantities of oil. Usually the rate of oil production is less when the production from wells is flowed, and although some engineers contend that maximum oil recovery by water-flooding can be obtained only by pumping the oil wells, the relative merits of pumping and flowing the oil production are controversial.

Many operators of water-flooding projects pump their oil wells at first, but plan eventually to flow all or at least a large part of their production when the ratio of injected water to oil produced becomes high for economic pumping.

In flooding projects at considerable depths, it may not be necessary to force the injection water into the sand by the pump; in such cases the water is allowed to flow in by gravity, the resulting hydrostatic head being then sufficient.

The average life and final outcome of water-flooding projects is more or less uncertain. The efficiency of water-flooding operations probably could be increased through better knowledge of sand conditions and by more information regarding the types of water and treatment necessary to avoid plugging of the sand. Many projects, especially in the older fields, are being operated without the benefit of core analyses, and on only the more modern projects have more than a few random core samples been tested. Without these data, the operator cannot intelligently complete his wells or regulate the operation of injection and producing wells.

OIL COMPANY STAFF CHANGES

Burt E. Hull R. B. McLaughlin

BURT E. HULL, president of The Texas Pipe Line Company, has been elected a vice president of The Texas Company. He will be given a leave of absence by The Texas Company to serve as president of Trans-Arabian Pipe Line Company, and will supervise the construction of the 1,050 mile oil pipe line from eastern Saudi Arabia to the Mediterranean Sea. Mr. Hull has had long experience in pipe line work and was general manager of War Emergency Pipe Lines, Inc., supervising the construction of the "Big Inch" and "Little Inch" pipe lines. Ralph B. McLaughlin of Houston succeeds Mr. Hull as president of The Texas Pipe Line Company.

Mr. Hull was born in Navosota, Texas, and joined The Texas Company in 1905 as a junior engineer with headquarters at Beaumont. From January, 1910, until July, 1922, he was chief engineer of the refining department with headquarters in Houston. In 1922 he was transferred to Tampico as vice president and general manager in charge of production, refining, pipe line, marine and sales operations of The Texas Company in Mexico, and remained there until 1926. He received the major oil company distinguished service award from the Texas Mid-Continent and Gas Association in 1943. During the same year he received formal citations by the American Petroleum Institute committee on pipe line transportation and by the Petroleum Administration for War in recognition of the successful completion of the Big and Little Inch pipe lines.

R. B. McLaughlin, born in Fredonia, Pennsylvania, joined The Texas Company in 1906 as a laborer, and became, in succession, junior clerk and paymaster. In 1914 he was appointed auditor of disbursements of the pipe line department.

When The Texas Pipe Line Company was organized in July, 1917, he was elected assistant secretary of that company and later served as secretary and treasurer. In June, 1939, he became vice president and assistant manager of The Texas Pipe Line Company and Texas-New Mexico Pipe Line Company. In March, 1942, he was appointed by the government as associate director of the transportation division of the Office of Petroleum Coordinator for War, later known as the Petroleum Administration for War. In that capacity he prepared a program of pipe line facilities as a substitute method of transportation because of the diversion and loss of tankers in East Coast service. When this program was completed, he was released to resume his duties with The Texas Pipe Line Company and other affiliated companies. He was elected vice president and manager of The Texas Pipe Line Company in 1943; also vice president of The Texas Empire Pipe Line Company and Kaw Pipe Line Company.

WILLIAM B. CASE has been made manager of marine transportation for Shell Oil Co., Inc. He succeeds M. E. Grant who has been appointed executive assistant to the vice president in charge of transportation. Mr. Case joined Shell at Tulsa as a valuation engineer in 1923. He served the company in various jobs at Tulsa, St. Louis and New York until 1941, when he was appointed assistant manager of the crude oil department at New York. In 1942 he went to Tulsa as acting manager of the department and remained there until last summer when he was transferred back to New York as assistant to the general manager of the transportation and supplies department.

Mr. Grant was trained in law and was attorney for the public relations department at St. Louis for some time. He has been engaged in various phases of transportation for Shell for ten years. In this new position as executive assistant to the department vice president, he will be responsible for coordination of supplies and transportation east of the Rockies.

B. H. ROBINSON, assistant manager of production for General Petroleum Corp., has been promoted to manager of joint interest operations, and R. O. Swayze has been promoted from assistant manager of the Rocky Mountain district in Wyoming to manager of the company's California drilling and production operations. Both assignments are to newly-created positions.

FRED H. BILLUPS has been appointed marketing advisor of Standard Oil Company (New Jersey) for the United Kingdom, the Scandinavian countries, Spain, Portugal and Malta. Mr. Billups joined the company in 1928 at a station in his native city of Norfolk, Va. He soon was made bulk plant agent at Wilson N. C., and by 1934 had become district manager in Norfolk. He became operations manager of the Virginia division in 1939 and four years later came to New York as assistant manager of domestic costs and operations, and in 1944 was appointed manager. The following year he was named assistant regional manager for the company's southern divisions.

Fred H. Billups

A. T. DOANE, formerly assistant to the vice president, marketing, in charge of employee relations and training of Shell Oil Co., Inc., N. Y., has been appointed assistant manager of the company's retail department. Mr. Doane is succeeded by J. C. Hopkins, assistant to the manager of the aviation department.

Mr. Doane joined Shell in 1931 as a lubricating oil salesman. During the war he served as a lieutenant commander in the Navy where he was responsible for the procurement of aviation gasoline and components.

R. L. CLIFTON, Tulsa, manager of the production department for The Carter Oil Company, retired March 1 after more than 29 years with the company. Clifton began his career with Carter in 1917 at Augusta, Kansas, as a district foreman. He helped developed Carter properties in the Seminole and Burbank fields and was in charge of production in the Oklahoma City field until 1936, when he went to Tulsa.

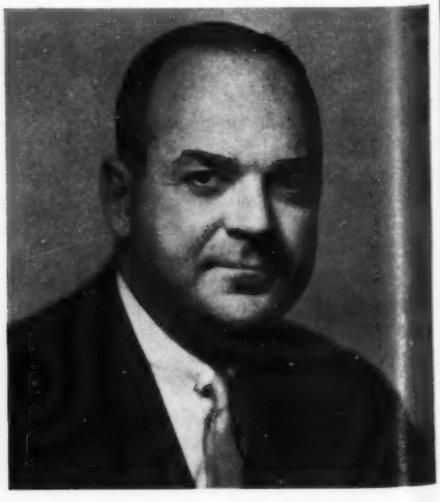
R. J. Sullivan will continue as assistant manager of the department, and O. N. Knox, Seminole, division superintendent for Carter in the Oklahoma-Kansas area, will be transferred to Tulsa as assistant general superintendent of the production department.

JAMES RENDALL HADEN, 57, manager of the merchandising department of Richfield Oil Corporation of New York, died suddenly February 25, 1947, at his home in Rockville Centre, L. I. Mr. Haden joined Richfield in 1929 when Richfield absorbed the Heath Oil Company of Binghamton, of which he was manager. In 1931 he was appointed manager of the service station department of Richfield and later became manager of the merchandising department.

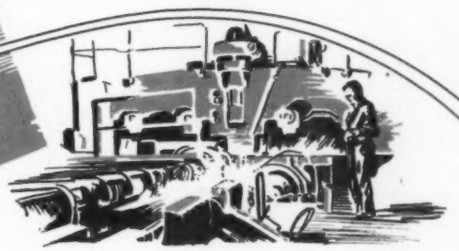
MAJOR JOHN B. DUCKWORTH, assistant director of research of Standard Oil Company (Indiana), was awarded the Legion of Merit by the United States Army Air Forces at the army air base at Park Ridge, Ill., March 4. Major Duckworth was cited for "his brilliant planning and execution of fuel development projects (which) were contributing factors in the supply of high quality aviation gasoline to our combat aircraft throughout the world."

AUGUSTUS C. LONG was recently elected vice president of California Oil Company, Ltd., in charge of all Caltex marketing operations west of Suez, particularly in the United Kingdom, Eire, Continental Europe and North Africa. Caltex distributes petroleum products from the Persian Gulf and the United States throughout Europe, Australasia, Africa and Asia.

Augustus C. Long



Youngstown TO OKLAHOMA



OKLAHOMA belongs in that group of states which have established the American Southwest as the world's richest oil repository.

Oklahoma is one of the great oil-producing states. It is third in number of producing wells, fourth in 1946 oil production, third in all-time production. It is a leader in drilling, too, third in the number of wildcat wells last year, as well as third in total completions. Oklahoma was one of the states to set a new producing depth record in recent months.

Youngstown has furnished drill pipe, casing, tubing and line pipe to Oklahoma ever since the names Osage, Cushing, Healdton, Seminole, and others were synonymous with new and important oil developments.

In new and undiscovered oil fields in the future, the oil fraternity can depend on the well-known orange banded pipe—to meet deep drilling needs or any other type of operating conditions, no matter how severe the requirements.

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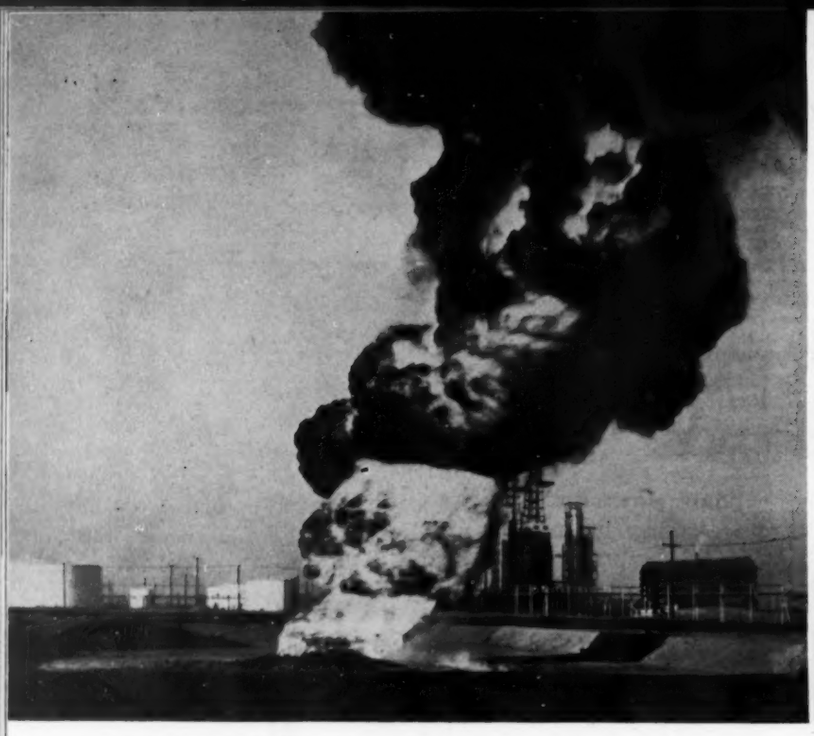


BEFORE: Clouds of black smoke were released by old method of burning.

AFTER: Note absence of smoke after new burners were installed.

SMOKELESS BURNING OF REFINERY VENT GASES

By A. K. BRUMBAUGH JR.*

MANY refineries which happen to be located in metropolitan areas face a severe problem in the disposal of waste light hydrocarbon materials, especially those gases and liquids which are discharged from safety relief valves and which consequently are produced in widely varying amounts not subject to direct control. This is particularly true of operations involving large gas-recovery, light-end fractionation, and alkylation units; for such equipment requires the holding in process vessels of considerable volumes of hydrocarbons. The special problems associated with materials in the propane-hexane range result from a combination of volatility at normal temperatures and vapor density appreciably greater than that of air; the high volatility means that discharged material may not be readily condensed, for example by water washing, and the high vapor density slows down dispersion by natural forces and encourages the formation of pockets of gas.

Most operators of this type of equipment have concluded that the only safe method of handling such vented material is burning. Early in 1946 General Petroleum Corp. instituted a program aimed at the development of equipment which would burn vent gases without objectionable smoke. The following discussion outlines the basis of this development and describes the installation recently completed.

As a first step a rather careful search of the literature was made but no reports of any approach to the problem were found. Without previous background, various methods of supplying and mixing air with the gas prior to ignition were studied with the result that the design of a venturi type aspirating burner was attempted. Mechanical methods of aeration, for example by blowers, had to be ruled out because the volumes of gas to be handled were so great as to require equipment of prohibitive size. Information for the design of the experimental unit was obtained from three sources given in the bibliography and this unit was set up for field tests.

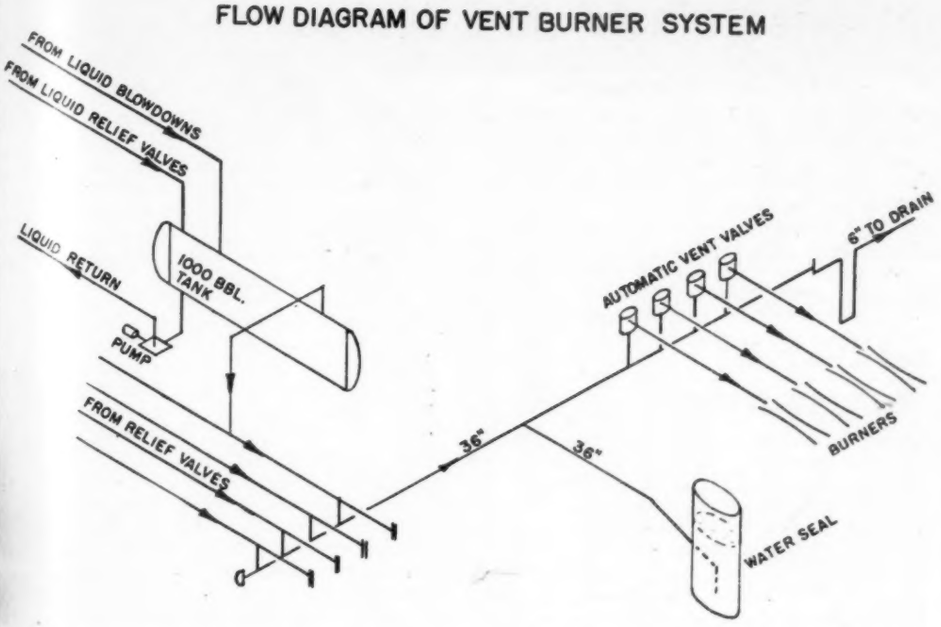
It was found that isobutane vapors could be burned without smoke using a ratio of venturi throat area to gas orifice area of 4 to 1. When isobutane containing considerable amounts, possibly 20%, of unvaporized material was fed to the burner it was necessary to substitute a smaller gas orifice thereby increasing this ratio to 16 to 1. With the 16 to 1 ratio the wet material burned without smoke, this despite the fact that liquid could be seen emerging from the burner mouth and entering the flame. Wet gas from the gas plant feed required a ratio of 8 to 1 for clean combustion. It has also determined that with the orifice ratio giving minimum satisfactory aeration the pressure upstream of the gas orifice could be reduced to ⅛ psig. without flame popping back. Below this limit operation was unstable; eventually the flame would travel back through the venturi tube and burn at the gas orifice; it was discovered however that a pressure of about 1 psig. would blow the flame through the tube and re-establish normal operation.

With the limitations of the venturi burner established, the application of such units to the refinery flare system was considered. As it was apparent that the permissible pressure at the gas orifice would control the size of the equipment, calculations were made to determine the effect of this back pressure on the relief valve system, with the result that 5 psig. was chosen as the maximum figure. Because all the vessels tied into the burner system had design pressures of 100 psig. or over, and the relief piping was adequately sized, it was found that for any reasonable assumption of emergency conditions the pressure rise in the protected vessel or vessels would be well within the margin of allowance set by the API-ASME Code. The effect of back pressure on the popping pressure of the relief valves could be ignored, as the greatest build-up at the downstream side of any valve was estimated at 15 psig. while the set pressure was at least 25 psig below the design pressure of the vessel in question. It was also decided to design the burner installation for a rate of 14,000 Mcf/D, this seeming sufficient for emergency discharges.

With an operating pressure range of ¼ to 4 psig., a given gas orifice would have a range of volume burned of 4 to 1. As the volume to be handled could be expected to vary from zero to the maximum it was decided to employ several burners of varying sizes with some sort of pressure responsive mechanism to cut them in successively. A conventional back-pressure control

* *General Petroleum Corp.*

FLOW DIAGRAM OF VENT BURNER SYSTEM



valve could not be used for this purpose for as soon as the burner was turned on the increased flow would drop the header pressure with the result that the valve would quickly shut off again, resulting in a cyclic intermittent action. To meet this problem an adaptation of commercially available control valves was made. With this mechanism adjustment, one pilot valve sets the opening of the main valve at any desired header pressure with the other pilot valve permits adjustment of the closing point to that pressure on the burner orifice which is the minimum for satisfactory operation.

A schedule of opening and closing pressures was set up for the series of burners, arranged so that the largest unit would be the last to cut in and the first to cut out. The size of the smallest burner orifice was next determined, being estimated from the surge capacity of the entire piping system and the normal amount of vapor leakage so that this burner would operate at fairly infrequent intervals to discharge accumulated material. The size of the next larger orifice was calculated from that of the smallest and the operating pressure schedule, being limited so that both burners at the cutout pressure of the second would burn only as much gas as the first burner alone at the cutin pressure of the second. It will be seen that this method of graduation provides a stable operating condition for any gas flow in the range covered, thereby avoiding intermittent operation. Other gas orifices were determined maintaining a similar relationship between the capacity of each additional burner and the total of those which would have previously cut in. Venturi tube dimensions were established by direct proportion to the experimental unit which had given good results, selecting a venturi area to orifice area of about 8 to 1 as the most generally desirable. Sizes and pressures finally used after slight readjustments to conform to readily available material and after field tests together with other pertinent data follow:

Burner Number	Cut In Psi	Cut Out Psi	Gas Orifice Diameter Inches	Venturi Throat Dia. Inches	Ratio Throat Area to Orifice Area
1.	2¼	¼	1.61	5	9.6
2.	2¾	½	2.9	8	7.8
3.	3⅛	¾	4.03	11.5	8.1
4.	3¾	1	7.0	18	6.6

To convey the vapors to the battery of burners all vent lines were combined in a 36-inch diameter underground header, each burner having an individual riser to its control valve. Provision was made for continuous drainage of condensate, all vents were pitched from the relief valve to the header from when a sealed gravity drain conducted liquid to the refinery recovery system. Because lack of capacity or failure of the automatic valves to operate might impair the functioning of the entire relief system, a branch of the main header was led to a water seal where its open end was submerged beneath 10 feet 4 inches of water, resulting in assured release of vapors at header pressures over 4½ psig.

In order to avoid liquid hydrocarbons reaching the burners, as well as save valuable material for re-use, discharge lines from relief valves of all vessels operating full of liquid, and hand controlled drains from reflux drums and the like were segregated and led to a 10-foot dia. by 78-foot long accumulator which in turn was connected to the burner header. Liquid trapped in this vessel can be pumped back to the plant.

Experience with previous simple flare installations indicated that arrangement of the burner setting to provide satisfactory service life despite the tremendous evolution of heat during an emergency would require serious consideration. Experiments with the first unit showed that the aspirated air kept the venturi tube itself relatively cool so it was thought that if provision were made to protect the burners from radiated heat and flame from adjacent units, fabricated steel venturis could be used. Thicknesses varied from ¼ inch for the smallest sizes to ½ inch for the largest. An air cooled wall 10 feet high and 50 feet long was constructed and the burners were installed flush with the surface through suitable ports. The wall consists of a 13 inch face of firebrick, a 2 inch air space, and an 8 inch thick reinforced concrete backing. Pipe nipples through the concrete along the bottom provide for convection circulation of air.

Since completion of the installation repeated operating tests have been made with uniformly good results.

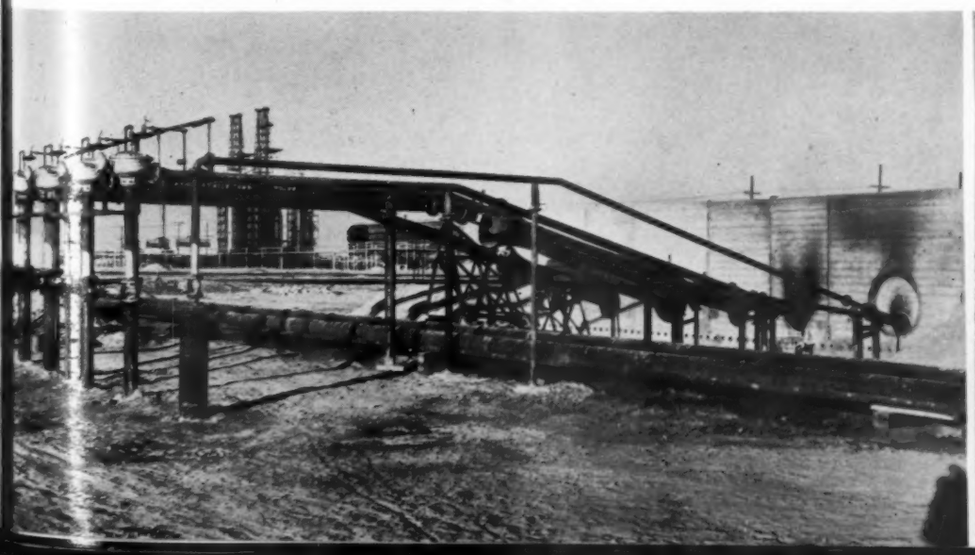
Bibliography:

The Aeration of Gas Burners—O. L. Kowalke & N. H. Ceaglske, American Gas Association Proceedings 1929, 662-686

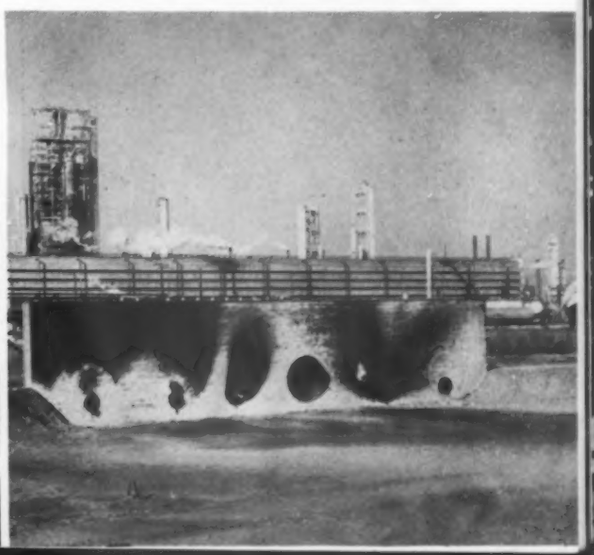
U. S. Bureau of Standards, Circular 394

U. S. Bureau of Standards, Technical Paper 193

Regulator manifold showing piping of burners.



Sump side view of burners.



International News and Notes

Romanian Exports

As a step toward relieving the serious shortage of rain in Romania, an agreement is being completed for the export of 75,000 tons of petroleum products to Switzerland, including 40,000 tons of motor fuel. Proceeds of the sale will be used for the purchase of cereals to be imported. The volume of crude oil treated by refineries in 1946 was roundly 29,750,000 barrels which was approximately 68 percent of prewar (1938) production. An increase of exports would be helpful to the economy of the country but is difficult to attain because of the shortage of machinery and supplies for the extension of drilling and repair of existing installations.

Colombia's Petroleum Council

Dr. Felix Mendoza has been designated as President of the newly-created National Petroleum Council of Colombia. The Council was established by act of the Colombian Congress and is directed to study the petroleum resources of the country and to make recommendations for their development.

Dr. Dunstan Retires

Dr. A. E. Dunstan, chief chemist of Anglo-Iranian Oil Co., Ltd., has retired after 30 years in the service of the company. His first connection with Anglo-Persian, as the company was then named, came as the result of research he had conducted on the viscosity of liquids. With his associate, Dr. Thole, he established in 1917 the company's research laboratory near Sunbury which developed under his guidance to its present important position.

Dr. Dunstan's interest in the development of petroleum chemistry was by no means confined to the operations of his own company. He was active in the Institute of Petroleum and was a member of the Council from its early days and served as president from 1929 to 1931. He also held the presidency of the British Association of Chemists and was a prominent figure in the Royal Institute of Chemistry and the Society of Chemical Industry. One of his conspicuous services was the editorship of the monumental work "Science of Petroleum."

Through his many activities over the past thirty years, Dr. Dunstan has formed a wide circle of friends on both sides of the Atlantic whose wish is that he may enjoy many pleasant and fruitful years in his well-earned retirement.

Dr. A. E. Dunstan

Rheem To Build in Australia

Rheem-Australia Pty. Ltd., Australian affiliate of Rheem Manufacturing Co., will erect a plant in Fremantle, Australia, to manufacture steel shipping containers. Initial production, scheduled for early fall, will be confined to six-gallon pails, the entire output of which will be taken by the petroleum industry. Equipment to make a full line of steel drums and pails will be added when steel is available. Rheem-Australia, jointly owned by Rheem Manufacturing Co. and Broken-Hill Pty. Ltd., is operating two plants in Sydney as well as plants in Melbourne and Brisbane.

Students Visit Manchester

Twenty-five students of l'Ecole Polytechnique of France visited factories and laboratories in the Manchester area in March. Prof. Pierre Baranger, head of the Laboratorie de Chimie Organique at l'Ecole Polytechnique in Paris, led the party. Prof. Baranger, who is also connected with the Centre de Technologie Scientifique at Finedon, near Wellingborough, Northants, spent the war years in Great Britain where he set up several laboratories. Last year he conducted a group of his students on a visit to factories in the Manchester area. Four of the students spent their summer holidays working in the laboratories of Manchester Oil Refinery Ltd., and the Manchester Oxide Company. Others hope to take similar courses this year.

Visits Middle East

Joe A. Lyne, chief field engineer for Parkersburg Rig and Reel Company, is visiting oil fields in the Middle East. While serving Parkersburg as chief field engineer in domestic operation, Mr. Lyne also has for the past 15 years covered South American operations.

Represents YPF in U. S.

Ing. Frederico Ramos Ruiz of Yacimientos Petroleos Fiscales, government-owned oil company of Argentina, arrived in the United States early in March to take charge of the company's New York office. Sr. Ramos Ruiz has been active in the Argentine oil industry for a number of years and since 1943 has been manager of the production department of YPF. Ing. E. R. Peters, who has represented the company in New York for sometime past, has been appointed superintendent of the Mendoza oil fields.

Ing. Frederico Ramos Ruiz

Industrial Installations

The Mitchell Engineering Group of Companies, Peterborough, England, has published a 320-page cloth-bound book titled "British Industrial and Engineering Installations." The book is beautifully illustrated and written to describe the products and services of the Mitchell group. Due to the wealth of data included, it should be classed more as a reference book than an engineering catalog.

There are 37 sections in the book. Those of primary interest to the petroleum industry include oil derricks; steam generators for refinery installations and transportable boiler units for field use; cooling towers; piling systems, pumps, cranes, winches, prefabricated buildings and building materials.

The Mitchell Companies regret that copies cannot be freely distributed for the applications have so far exceeded the limited number of copies printed. Responsible engineers and industrial executives are invited to apply for copies to Mitchell Engineering Group, Department P., Fengate House, Peterbough. British Industrial & Engineering Installations—price 25/- net.

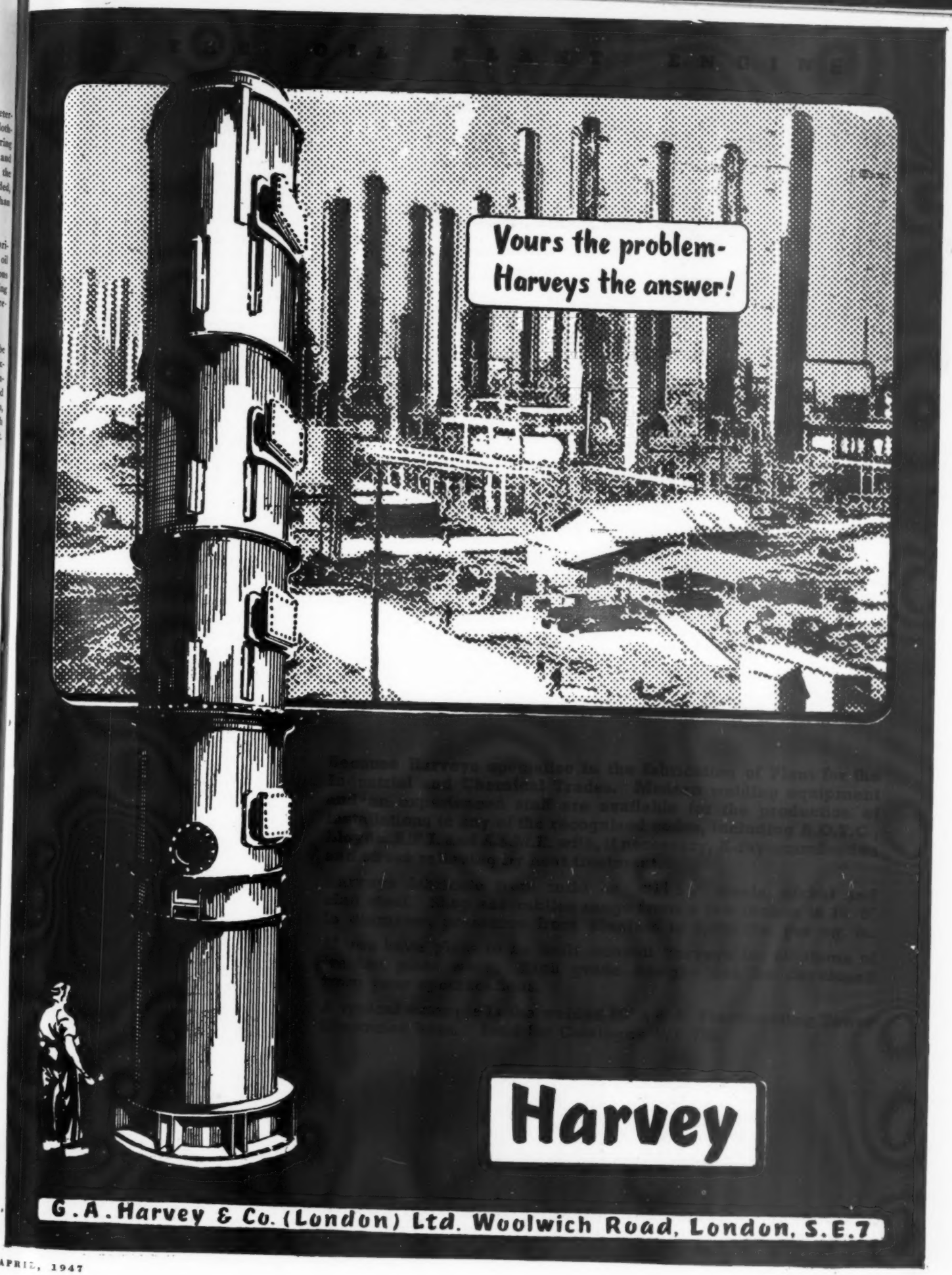
Trans-Arabian Pipe Line

Preparations for the 30-inch pipe line of Trans-Arabian Pipe Line Co. from the Persian Gulf to the Mediterranean are going forward steadily. Sometime ago the company placed project orders with Consolidated Steel Corporation and the United States Steel Corporation for the pipe and other steel needed for the line which is estimated to require 275,000 tons. Early in April a party of engineers, headed by W. C. Seal, will leave the United States to make a ground survey of the route. Construction of the line will be in charge of the Bechtel Corporation.

Transamerican in Mexico

Victor E. Milch, resident partner in the United States of Transamerican Factors, Ltd., Los Angeles, exclusive exports representatives for "Black Magic" oil base drilling mud, and several manufacturers of equipment for the petroleum industry, has announced the appointment of Churchill Murray, of Importadores Tecnicos, S. A., Dolores 16-605, Mexico City D. F., as exclusive representative for the Republic of Mexico. Members of this well-known agency are technically qualified to render efficient representation to the petroleum industry in that country.

Churchill Murray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International Petroleum Moves To New Home

International Petroleum Co., Ltd., has converted the building at 434 University Ave., Toronto, into an efficient, modern headquarters from which the extensive exploratory, development and marketing activities of more than 15,000 employees are directed. Until last fall International shared offices at 56 Church St. with Imperial Oil, Ltd., but overcrowded conditions necessitated the move.

The company, the largest under Canadian charter in South American oil fields, has interests, together with affiliates, in four countries in the northwest corner of the continent—Venezuela, Colombia, Peru and Ecuador. In each a long-range program of necessary expansion is being conducted which is requiring large expenditures in the field.

In Colombia and Peru, the company produces, refines and markets its own products. The Infantas-La Cira field in Colombia is the company's largest producing field. In Venezuela, which ranks third among the world petroleum producers, it has a 25 percent interest in the producing properties of the Mene Grande Oil Company. In Ecuador it has a 60 percent interest in the International Ecuadorean Petroleum Company which is carrying on intensive exploration.

The Tropical Oil Company has been operating the De Mares concession in Colombia approximately 25 years for International Petroleum. This area is situated in the Magdalena River valley about 350 miles inland from Colombia's northern coast. Before Tropical's advent, the entire region was a dense jungle, sparsely populated. Today El Centro is a thriving community in the heart of what was once wilderness.

Since the beginning of operations, over 1,200 wells have been completed on the concession. Tropical and the Andian National Corporation which transports its crude from El Centro to the Mamonal docks at Cartagena employ more than 7,000 persons.

On joint interest with affiliates, Tropical initiated drilling of two exploratory wells off the concession in new areas at Costa Rica and Tubara in northern Colombia. Additional wells will be spudded in the near future in the Llanos, south of the Meta River and at San Antonio near La Dorada.

The production from International Petroleum's fields on the La Brea-Parinas estate in northern Peru is refined at the company's plant at Talara. This important seaport refinery supplies the domestic market and provides export products for the west coast of South America and Australasia.

International Petroleum has been operating in Peru for more than 30 years. The productive area of the estate at present is about 20,000 acres. To date 3,500 wells have been drilled. Under the company's conservation policy, all surplus natural gas is returned to the sands to increase the ultimate recovery of petroleum.

The strategically located Peruvian field was a major factor in naval and military operations in the Pacific theatre during the war. Today it is making an important contribution to industry and the general economy of the west coast countries.

International Ecuadorean has explored in the neighborhood of 15,000,000 acres of territory and drilled 19 deep exploratory wells. These wells were located by the most modern exploration methods in well-defined geological structures, in an area strategic for hemisphere defence and peacetime development, but oil in commercial quantities has not yet been found.

The area explored extends from Puna Island and the adjacent mainland south of Guayaquil along the coast north nearly to the Colombian border. Nearly 700 persons are engaged in this exploration work which has entailed large expenditures.

In Peru, Colombia and Ecuador operations involve the maintenance of living facilities for thousands of employees on the payroll and their families. The high level of employment and increased payrolls are an important contribution to the national economy.

To Liquidate Intava

Intava, Inc., joint foreign aviation fuel marketing organization of Standard Oil Company (New Jersey) and Socony-Vacuum Oil Company, Inc., will be liquidated by the end of 1948. Existing contracts and services will be absorbed by marketing affiliates of either of the two parent companies. By the end of 1948 the two companies expect to be in a position to provide independently aviation products and services on a world-wide basis.

Intava, Inc., is the successor to International Aviation Associates, which was organized in 1936 to coordinate supply of aviation oil products and services on a world-wide basis outside the United States, which at that time neither company was able to furnish independently. Through Intava the two companies have been able to supply to any international air lines under a single contract standardized aviation products and service. During the war Intava supplied aviation oil products to the U. S. Air Transport Command and to other Allied air services and established and maintained fueling and servicing depots which were of major service to the war effort. Prior to 1945 principal offices of the company were in London.

Venezuela's 1946 Production

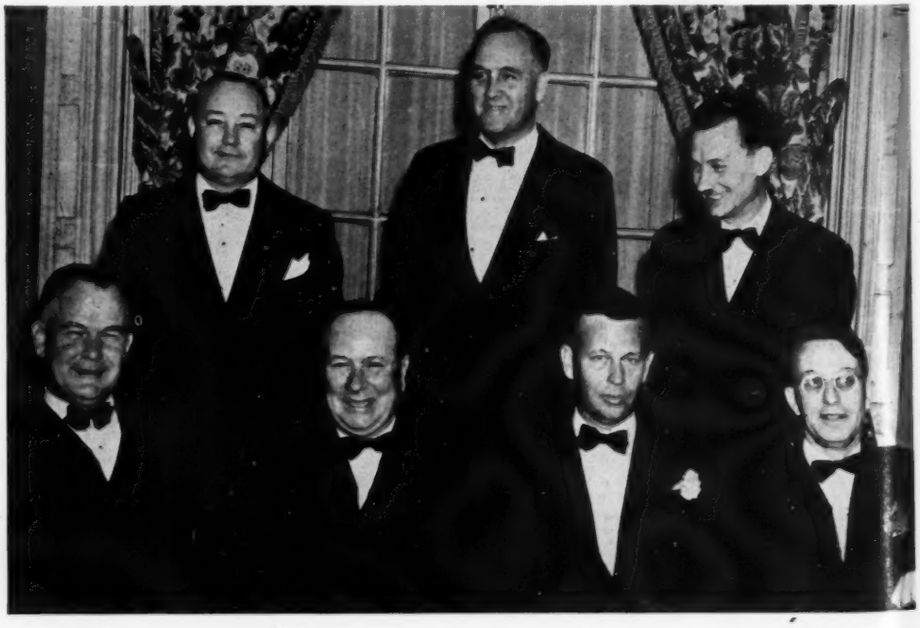
Production of crude oil in Venezuela during the year 1946 amounted to 388,528,313 barrels, an average of 32,377,359 barrels per month, or 1,064,461 daily. Exports for the year totaled 348,220,848 barrels. The following table shows operated production by companies.

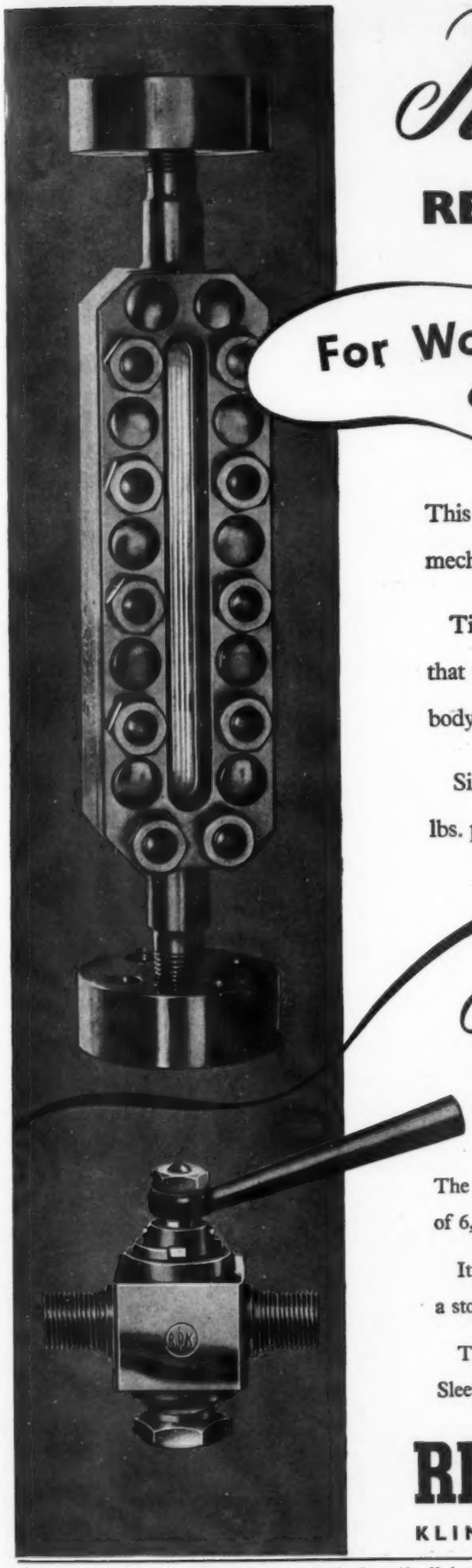
Company	West	East	Total
Creole	147,259,752	55,767,148	203,926,900
Mene Grande	19,783,579	46,786,973	66,570,552
Shell	99,226,215	——	99,226,215
Consolidada	——	9,789,076	9,789,076
Socony	——	8,033,266	8,033,266
Texas	——	1,269,018	1,269,018
B. C. O.	396,691	——	396,691
Guasare	5,392	——	5,392
Orinoco	99,318	——	99,318
Phillips	——	20,206	20,206
S.A.P. Las Mercedes	——	63,107	63,107
Atlantic	——	28,572	28,572
Total—Bbls.	226,770,947	121,757,366	388,528,313
Exports—Bbls.	247,528,202	100,692,646	348,220,848

FOLLOWING the assignment of Col. Walter L. Forster to the managership of Shell interests in Venezuela, A. L. Toone has been appointed to his former post as general manager of Shell operations in Colombia. Mr. Toone has been a member of the Shell organization for many years, much of the time in the Far East.

Los Angeles Nomads Officials

Officers for the current year of the Los Angeles chapter of Nomads were installed recently at an inaugural ball at which the above photograph was taken. Standing, left to right, are T. Sutter, regent; J. A. Engstrand, assistant secretary; Bill Bettis, regent. Sitting: Fred Ripley, vice president; R. J. Eiche, president; Waldo Moore, treasurer; Earle Boggess, deputy sergeant at arms. Other 1947 officers not in the picture are Lee Laird, sergeant at arms; B. M. Landis, secretary; and B. Reinhold, assistant treasurer.





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Brig. Gen. James Creel Marshall

Gen. J. C. Marshall Joins Kellogg

Brig. Gen. James Creel Marshall has been retained on the engineering staff of The M. W. Kellogg Co. Gen. Marshall will apply a life-time of technical knowledge and experience to the broad range of new engineering and research projects included in Kellogg's immediate program.

Foremost among General Marshall's more recent army activities was his service on the atom bomb project. In June 1942 he was directed to form the organization which became the Manhattan Engineer District, charged with the development of the atom bomb. Later he was on active duty in Australia, New Guinea and the Philippines. During the latter half of 1945, he commanded the Boston port of embarkation and in 1946 was made president of the engineer board, the research and development agency for the Corps of Engineers, stationed at Ft. Belvoir, Va. Before the war he was area engineer at Albany, N. Y., in charge of the $27,000,000 improvement project on the N. Y. State Barge Canal in 1935.

Cooper-Bessemer Announces Price Policy

Establishment of a "firm price policy" as a means of holding the price line, both in connection with the sale of its diesels, gas engines and compressors and also the purchase of component materials and parts, has been announced today by The Cooper-Bessemer Corporation. The company believes that this is the best way to stop the increasing inflationary trend, even though this policy contains certain hazards in a heavy industry where several months are required to manufacture a product after an order is received.

New SSC Subsidiary

Seismograph Service Corporation has just purchased the controlling interest in the American Exploration Company of Lafayette, La., it was announced by G. H. Westby, president of SSC. Management of American Exploration Company will continue unchanged at Lafayette. American Exploration is particularly equipped and experienced in conducting marine exploration. Its activities are presently being conducted in the Gulf Coast of Texas and Louisiana.

J. E. Lee, Jr., president of American, has been engaged in geophysical work since his graduation from Colorado School of Mines in 1937. He was with Heiland Research Corporation and later with Kerr-McGee Oil Industries, Inc., in various capacities until becoming chief geophysicist in 1942. On July 1, 1946, he resigned from Kerr-McGee to assist in organizing American Exploration. He and L. F. Guseman, vice president, have been jointly in charge of geophysical interpretation.

L. F. Guseman, vice president and treasurer, was employed for many years in the geophysical division of The Texas Company, where he served in various capacities on reflection seismic parties, with some four years of marine experience in the Gulf Coast of Louisiana.

H. R. Conley, secretary, has been active in radio and in marine exploration in the Louisiana coast employing both refraction and reflection techniques. He resigned from The Texas Co. to become associated with the American in 1944.

American Exploration Comuany is the sixth subsidiary of SSC, the others being Seismograph Service Corporation of Delaware; Westby Geophysical Corporation; Seismograph Service Limited; Seismograph Service Corporation of Venezuela and Servicios Seismograficos de Colombia S. A. The Seismograph Service group now operates in Venezuela, Colombia, Trinidad, Bahama Islands, Mexico, France, Egypt, Iraq and U. S. A.

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George H. Schoenbaum

GEORGE H. SCHOENBAUM, engineering representative of Standard Oil Co. of New Jersey at Detroit, will be transferred to London soon. In his new assignment he will be foreign technical representative of foreign marketing coordination. He will be succeeded by Harry L. Baker of Esso European laboratories who will return from London about June 1.

Mr. Schoenbaum has been with the New Jersey company since 1930 except for a five-year military leave in the Ordnance Department and in the office of the Quartermaster General. In the Ordnance Department he was chief of field service in the fuels and lubricants branch. Among other jobs with the Quartermaster, he was chief of the purchase section, operations branch, fuels and lubricants division.

In the ten years following his graduation from Virginia Polytechnic Institute in 1930, Mr. Schoenbaum specialized in technical sales and service in Virginia, Washington, D. C., and Detroit. The Detroit assignment which he now leaves involved liaison between various branches of the company and the automotive industry.

L. T. KITTINGER has been appointed resident vice president of Shell Oil Co., in Washington, D. C. He succeeds R. B. High who recently retired after 33 years with the company. Mr. Kittinger joined Shell in 1919 as a fuel oil salesman in San Francisco and became sales manager in 1931. Four years later he was transferred to New York and in July, 1936, was appointed vice president, marketing. In 1942 he was granted a leave of absence to serve with the War Production Board. He returned to Shell in 1943.

A. P. ENDRES has been made assistant to W. B. Curtis, public relations director of the General Petroleum Corporation. Mr. Endres has been with General eight years, mostly in advertising and sales promotion.

EDWARD S. HOCHULI has been appointed manager of marine sales for the northern California division of General Petroleum Corporation. He has a varied background of seafaring experience in both the merchant marine and the Navy.

HUGH B. GILL has been appointed market research representative for the northern California division of General Petroleum Corporation. He will study existing and potential markets and methods of distributing, packaging, pricing and merchandising of products and services.

FRED A. SHELLHORN has been appointed traffic manager for Anchor Petroleum Co., Tulsa. He formerly was traffic manager for Hanlon-Buchanan interests. Mr. Shellhorn is president of the Tulsa Traffic Club and vice chairman of the executive committee of the transportation department of the Tulsa Chamber of Commerce. Apchor is engaged in the marketing of LPG and natural gasoline.

L. H. BUTTERWORTH, assistant general foreman in the light oils division of the Whiting, Indiana, refinery of Standard Oil Company (Indiana), has been promoted to assistant general superintendent of the company's Casper, Wyoming, refinery. He joined Standard of Indiana in 1937 as a chemical engineer in the research department at Whiting. In 1942 he was transferred to the manufacturing department.

JAMES M. McLAUGHLIN retired as general manager of the Wadhams division of Socony-Vacuum Oil Company, Inc., on March 1. He had been with the company for 20 years and has been general manager of Wadhams at Milwaukee since 1940.

M. G. Peeters succeeded Mr. McLaughlin as division manager. He has been with the company for 27 years and has been sales manager of the Wadhams division for the last seven years.

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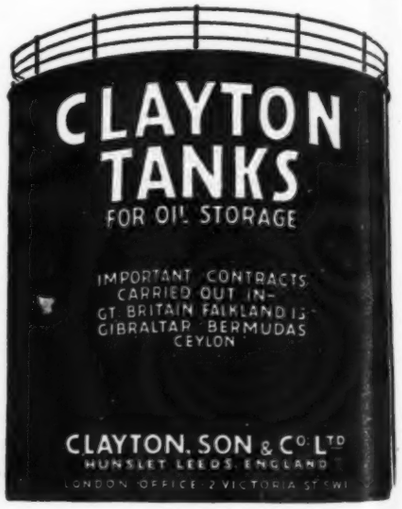
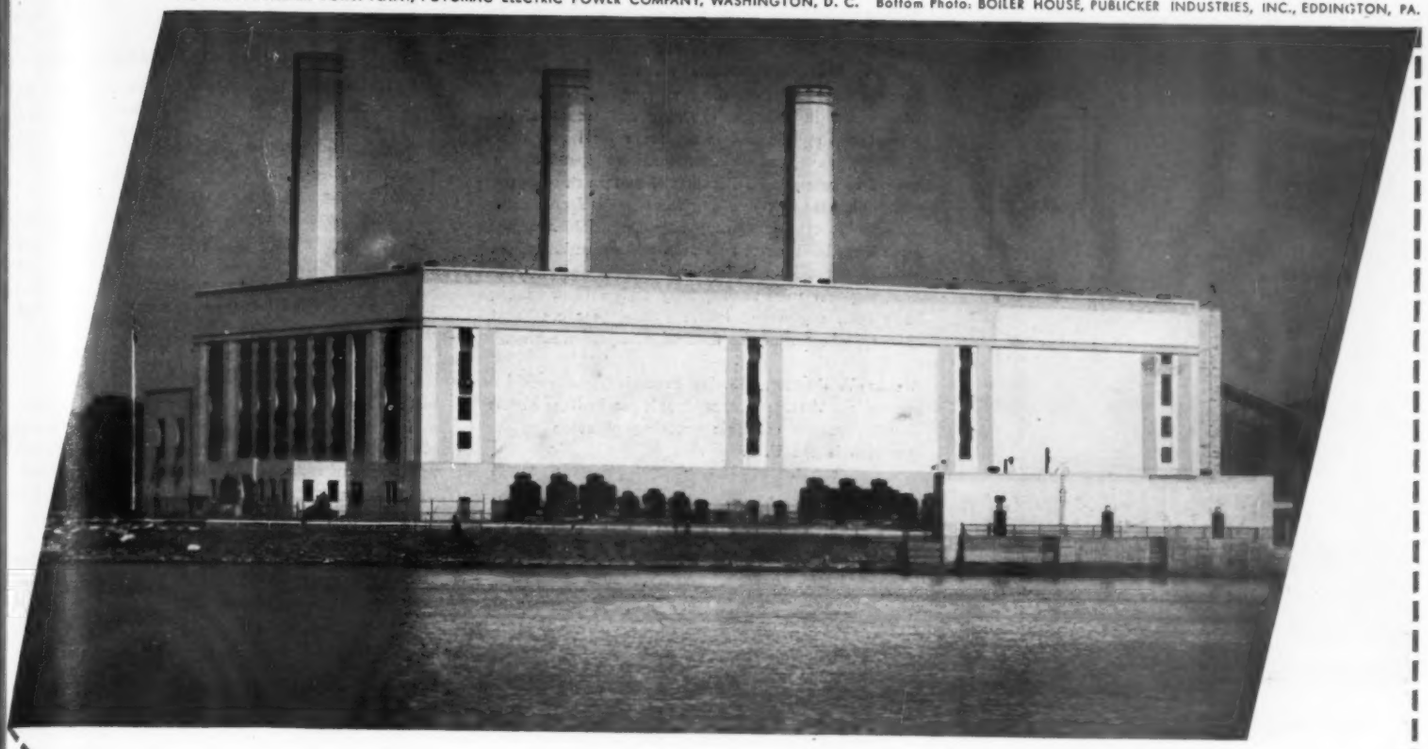


Top Photo: BUZZARD POINT PLANT, POTOMAC ELECTRIC POWER COMPANY, WASHINGTON, D. C. Bottom Photo: BOILER HOUSE, PUBLICKER INDUSTRIES, INC., EDDINGTON, PA.



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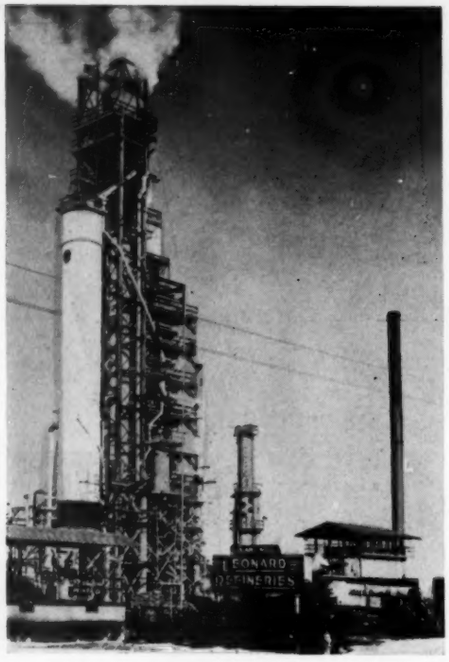

Leonard Small Cat On Stream

The first postwar catalytic cracker designed to meet the competitive needs of the small refiner went on stream at Leonard Refineries, Inc., March 18. This 3,000-barrel unit is a thermo-catalytic cracking plant licensed and engineered by Houdry Process Corporation and built by its subsidiary, Catalytic Construction Corporation. Operations began just six months from the time that ground was broken last September.

The Leonard TCC unit is compact in design, with the overall height substantially reduced and the structure considerably simplified, although all modern improvements in catalytic cracking are included. One important simplification is an integral elevator design requiring only one elevator for both spent and regenerated catalyst. Utilization of certain existing thermal equipment in converting the refinery from thermal to catalytic cracking provided substantial savings in investment both for construction and operation. Flexibility of operation and higher percentage of on-stream time, together with high quality and yield of gasoline have been engineered into the small cat cracker by Houdry, pioneer in the field of catalytic cracking.

Arthur V. Danner, Houdry executive vice president, pointed out that the Leonard unit marked the sixtieth Houdry-licensed catalytic cracking plant to go into operation in the U. S.

Keif Heads Aviation Committee

The Aviation Advisory Committee to the American Petroleum Industries Committee of the American Petroleum Institute has elected the following officers for the year 1947: Aubrey Keif, The Texas Company, chairman; L. A. Henry, Standard Oil Company of Indiana, vice chairman; and A. T. Hapke, American Petroleum Industries Committee, secretary.

Industrial Relations Department

The Western Petroleum Refiners Association has organized a new department of industrial relations. The new department will report to members and the industry on current legislation, decision and regulations. James T. Rasbury has been appointed director of the division and began working on March 15 at association headquarters, 1414 Hunt Building, Tulsa.

Plans Housing For Researchers

To provide housing facilities for an expanding staff at its research and development laboratories in Paulsboro, the Socony-Vacuum Oil Company, Inc., has completed preliminary arrangements with the New York Life Insurance Company for a housing project for approximately 150 families at Woodbury, N. J., to be developed and managed by New York Life. The laboratories now employ 800 persons. The new housing will be available early in 1948. A 44-acre tract is under option pending cost studies. Preliminary plans are for garden-type apartments and single-family houses.

Cyclotron Oil

Gulf Oil Corp. research laboratories have developed a new oil designed to withstand the catalytic action of the large amounts of copper used in cyclotron production of radio-active elements. Initial application is in the new cyclotron of the University of Pittsburgh which contains 18 miles of copper ribbon weighing 18 tons, coiled around the poles of a 90-ton electromagnet. Oil capacity of the unit is 467 gallons. Transformer oils previously used in cyclotrons have broken down quickly, requiring frequent changes.

Arabian Concession Area

In a statistical summary accompanying an article on Middle East Oil in February WORLD PETROLEUM, the extent of the Arabian American Oil Company's concession in Saudi Arabia was printed as 281,280 acres. This was a typographical inadvertence arising from the printer's omission of three ciphers from the figure which should have been 281,280,000. Otherwise stated the concession is roundly 450,000 square miles. The context of the article made it clear that the smaller figure was in error, but to avoid any possible confusion the correction is being recorded.

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Tiros Petrol Tank-Wagon Fittings have been specifically designed to prevent fire, explosion or leakage of petroleum products in transit. Simple and effective, they can be fitted to existing tanks at reasonable cost.

Our new Brochure gives full details and prices of this important Safety Gear. You will want a copy. Write for it to-day.

TIROS Fittings comprise :—

REMOTE CONTROLLED EMERGENCY VALVES, fitted to bottom connection of each compartment — a safeguard against leakage in case of damage to under-tank piping.

PRESSURE-VACUUM RELIEF AND ANTI-SPILL VALVES —automatically relieve pressure and vacuum and prevent spilling of spirit should the vehicle overturn.

SAFETY VALVES—a safeguard against explosion in case of fire outside the tank.

TOP FILLER CAPS—allow ample clearance for escape of displaced air and gas, when using standard 2½" filling lines.

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ASSURES FREEDOM FROM SCALE: This line pipe is formed cold. With no heat applied, there is no loose scale . . . and no danger of pipe failure due to inner surface sections breaking loose, leaving thin, weak spots in the wall.

SAVES LAYING TIME: Extra long pipe lengths are made with this improved process. Fewer joints and easier field welding mean faster laying time. The joints fit accurately, due to uniform wall thickness and perfect roundness of the pipe.

HIGHER PHYSICAL PROPERTIES FOR CASING AND TUBING TOO: Today's high speed drilling and deep holes demand higher physical properties. Republic's answer is a higher grade steel, the improved electric weld process and full normalizing of every length. Result: a high yield point . . . extra resistance to external fluid pressure and to pulling out at the joints.

PROVED PERFORMANCE: More than 40,000 miles of Republic Electric Weld Line Pipe and 130,000,000 feet of Casing and Tubing attest to the complete dependability of Republic Electric Weld products.

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REPRESENTATIVES IN PRINCIPAL CITIES OF THE WORLD

Tide Water's Novel Publicity Device

Tide Water Associated Oil Company has taken to the air to publicize its products and has put into service what is said to be the largest animated advertisement ever constructed. The medium adopted is an ex-Navy dirigible which did good service on the Atlantic patrol during the war. It is 253 feet long and features Tydol "Flying A" gasoline. A letter "A" fifty-three feet high with wings 118 feet long appears on one side and a huge "Tydol" on the other. The sign is readable at five miles by daylight, and at night it is illuminated by 11,500 electric bulbs, making it even more spectacular. In addition to this illumination, the ship carries a composite electric sign which can flash news items and weather reports as well as advertising messages.

The Tydol airship will operate along the Atlantic Coast and in thirteen northeastern states. Its night flights will carry it over amusement parks and other places where crowds are gathered as well as other cities, towns and countryside. As a publicity feature the advantages of a movable display that can cover an area containing a fifth of the country's population are obvious.

White Operators' Manual

A manual for natural gasoline plant operators now is in course of compilation by the Natural Gasoline Supply Men's Association in cooperation with the technical committee of the Natural Gasoline Association of America. Purpose will be to provide plant and field men with best available information on every phase of the industry, well illustrated and written in simple terms. V. C. Canter, manager of Jones & Laughlin Supply Co., has assigned various chapters to individuals and groups for early assembly.

Completes Tanker Fleet

With the recent acquisition from the U. S. Maritime Commission of the type T-2 tanker SS "Camp Charlotte," Tide Water Associated Oil Co. has taken five vessels to meet its East Coast marine transportation requirements. The "Camp Charlotte" has been renamed the "Robert E. Hopkins," replacing the vessel of the same name, lost in the North Atlantic Ocean in February, 1943, as a result of enemy action.

The first three tankers acquired from the Maritime Commission were renamed "Byron D. Benson," "David McKelvy" and "Samuel Q. Brown," in honor of the first three company vessels lost during the war. The fourth tanker acquired has been renamed the "William F. Humphrey" to replace the vessel of the same name which was lost approximately 800 miles off the African Gold Coast in July 1942 following an attack by an enemy raider.

Contract Awarded

Work has begun on the change of catalyst and case repair on the four-case Houdry Fixed-Bed Cat Cracker at Socony-Vacuum's East Chicago, Indiana, refinery, it has been announced. Contract for the work has been awarded to Catalytic Construction Company which completed similar work at Socony-Vacuum's Paulsboro plant March 15.

Gulf Guides Yachtsmen

Bureaus which will provide information on harbor facilities and cruise planning for yachtsmen are being opened this month in nine East Coast, Gulf and Mid-Western cities by Gulf Oil Corporation. Cruisegide centers will supply detailed data on harbors and waterways along the Atlantic and Gulf Coasts of the United States. For the present only a limited amount of information on the Great Lakes and Mississippi River is available. Bureaus are located in Gulf sales offices in Boston, New York, Philadelphia, Atlanta, New Orleans, Houston, Louisville, Toledo and Pittsburgh.

Sulfur in Petroleum

As a part of a research program designed to assist refiners in utilizing high-sulfur crude oils, the Bureau of Mines has published a paper giving the physical properties of more than 300 sulfur compounds. The boiling points, freezing points, densities and refractive indices are listed.

A copy of Report of Investigations 4060, "Sulfur in Petroleum; II, Boiling Points, Freezing Points, Densities and Refractive Indices of Some Sulfur Compounds," may be obtained by writing to the Bureau of Mines, Department of the Interior, Washington 25, D. C.

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ANGUS CUPS

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Angus Cups—the first high-grade Valve and Seating Cups of British manufacture—are now available to Oil Field Engineers. Produced from "Gaco" Fabric composition, an extremely tough and wear-resisting compound, with our famous "Gaco" synthetic rubber as the bonding medium.

Layers of fabric are impregnated with "Gaco" and moulded under heavy pressure to form a tough compact composition capable of resisting the action of abrasion, crude oils and gases at high working pressures and temperatures.

Years of intensive research are behind the development of Angus Cups. Supplied in three hardnesses, sizes as laid down by A.P.I. standards.

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Our "Gaco" synthetic material, which achieved a wide reputation before and during the late war as a medium for hydraulic sealing in aircraft and engineering mechanisms, is also now available for the manufacture of other products used in the Oil Industry.

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SOCONY-VACUUM

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W. F. Moore

F. A. DAVIS has relinquished the presidency of Arabian Oil Company and has accepted the post of vice president in charge of exploration. In announcing the change, H. D. Collier, chairman of the board of Arabian American, explained that it was made in order to relieve Mr. Davies of administrative duties, enabling him to devote his time and enegries to the important task of developing production in Saudi Arabia. He was among the first group of engineers and geologists to enter Arabia after the concession was obtained and has directed the company's operations from the time of its foundation.

The new president of Arabian American is W. F. Moore who has been in charge of foreign operations of The Texas Company. He joined the Texaco family in 1920 as assistant power plant operator in the Port Arthur refinery. In 1929 he became assistant to the manager and later assistant to the vice president in charge of refining. In 1930 he became operating head of process companies in which Texas was interested, including Gasoline Products Company, Gray Process Corporation and Process Management Company. In 1938 he was appointed assistant manager and in the following year manager of The Texas Company's purchasing department. In 1943 he was made assistant to the vice president in charge of foreign operations and in 1945 he became general manager of that division.

Aramco-Standard Deal Deferred

Announcement was made on March 12 by Arabian American Oil Company that an agreement had been reached whereby acquisition by Standard Oil Company (New Jersey) and Socony-Vacuum Oil Company, Inc., of stock interests in Arabian American Oil Company is delayed pending outcome of current discussion and legal action in London concerning a group agreement reached in 1928 among participants in Iraq Petroleum Company.

"An 'agreement in principle' with Jersey and Socony-Vacuum was reached in December last," the announcement states, "whereby these two companies would acquire a total of 40 percent of Arabian American's capital stock—30 percent by Jersey and 10 percent by Socony-Vacuum. Arabian American is now jointly owned by The Texas Company and Standard Oil Company of California.

"In order to make funds available pending acquisition by Jersey and Socony-Vacuum of this stock, the Arabian American Oil Company has borrowed $102,000,000 on a bank loan. The loan will extend over a ten-year period, and of the total amount, $76,500,000 has been guaranteed by Jersey and $25,500,000 by Socony-Vacuum. Upon completion of the acquisition by Jersey and Socony-Vacuum of stock in Arabian American, the purchase payments will be used to retire the loan.

"Arabian American plans to accelerate the development of its producing facilities and to install additional refinery equipment. It also contemplates building a railroad to serve its operations in the producing fields. In addition a new deep water port will be constructed at Dammam on the Persian Gulf.

"A separate loan of $125,000,000 is being arranged in order to provide funds for construction by the Trans-Arabian Pipe Line Company of a 30-inch pipeline from the Persian Gulf to the Eastern Mediterranean. This loan, for a fifteen year period, will be guaranteed by Standard Oil Company of California, The Texas Company, Standard Oil Company (New Jersey), and the Socony-Vacuum Oil Company, Inc. It is planned that at such time as the stock interest in Arabian American is taken by Jersey and Socony-Vacuum, they will also acquire stock interest in Trans-Arabian Pipe Line Company now owned equally by California Standard and Texas, so that the new interests in Trans-Arabian will be in the same proportions as the new interests in Arabian American.

"To meet the requirements of the new 30-inch pipe line, it will be necessary for Arabian American to increase its production substantially between now and the end of 1949, when the pipeline is expected to be completed.

"All the interested departments of the U. S. government have been kept fully informed of the progress of these negotiations."

A vital link
CALLENDER-HAMILTON BRIDGES
An alternative to the main road bridge over the Thames at Staines was required during the war and this Callender-Hamilton bridge was chosen. Its 264 feet in three spans carrying two roadways of 18 feet and 10 feet respectively was erected from interchangeable jig-drilled galvanised steel units. Maintenance and painting costs are reduced by the hot-dip galvanising process, a feature unique in bridge construction. Callender-Hamilton bridges of every type from light foot and cable carrying structures to the heaviest road and rail bridges are to be found in all parts of the World.
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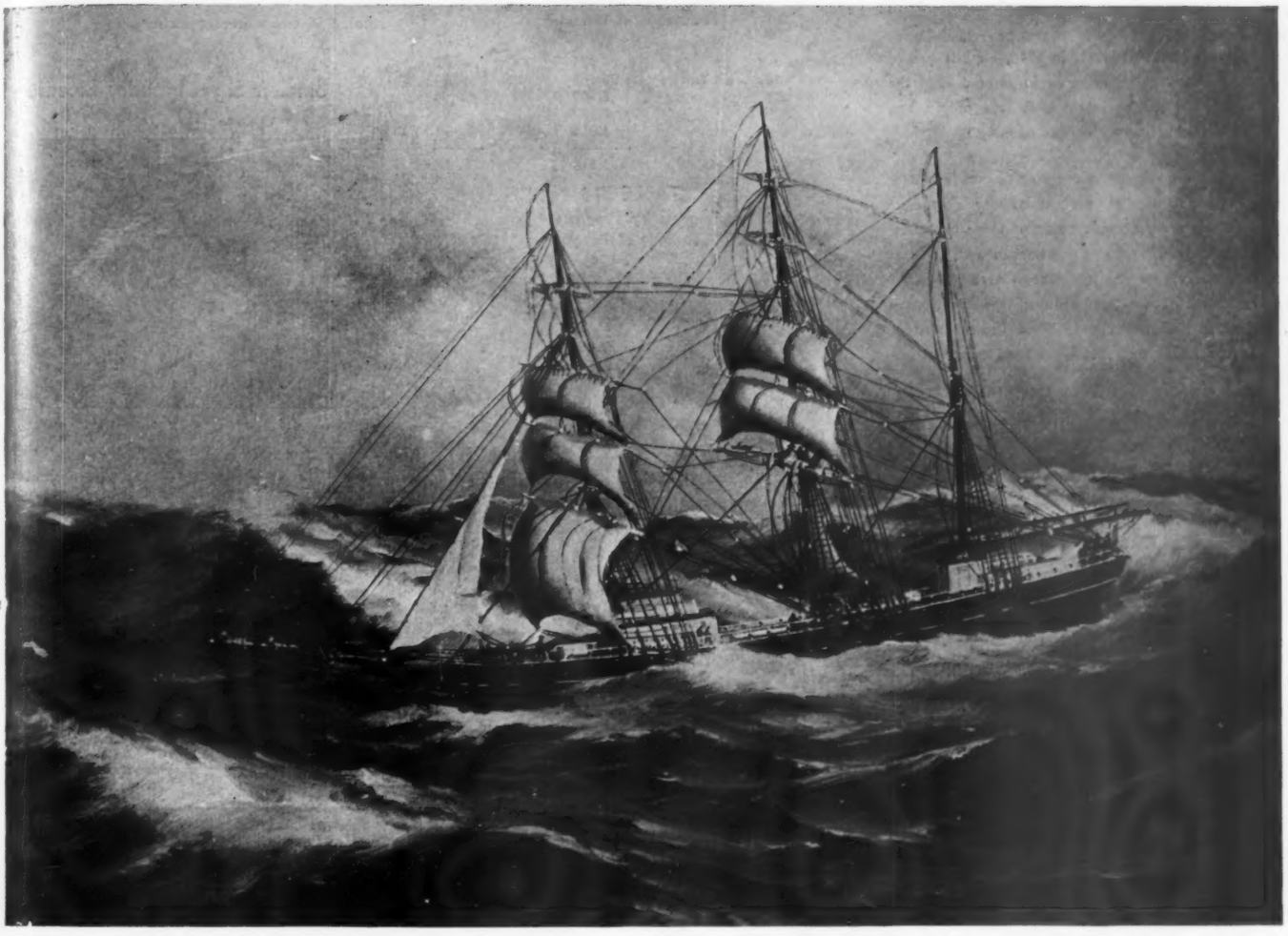

The Barque Georgietta, 459 tons, "running down her easting" in the Indian Ocean, en route to Australia from New York, in the "eighties", carrying case oil.

SINCE THE DAYS OF SAIL AND CLIPPERS

Standard-Vacuum Oil Company and its affiliated companies pioneered the distribution of petroleum products in Australia, New Zealand, the Far East, India, South and East Africa. For over 50 years we have marketed high grade petroleum products in those areas.

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U. S. Exports and Imports

Imports of crude oil and products into the United States during 1946 averaged 378,000 barrels daily as compared with 310,000 barrels in 1945, an increase of 22 percent. The total volume of imports during the year was 138,094,000 barrels which was only seven percent of the total supply of the country.

Practically all imports consist either of crude petroleum or residual oil, 94 percent of the shipments received during the past year being of these two categories. Similarly the great preponderance of imports came from one region, the Caribbean area. In 1946 some 87 percent of the total volume was credited to Venezuela and the Netherlands West Indies, most of the latter consisting of refined products which originated in Venezuela.

While imports increased during 1946, exports declined from the level of the wartime years of 1944 and 1945 but were still 50 percent higher than in the prewar years of 1941.

TABLE I

Imports and Exports
(Thousands of Barrels)

	Imports	Exports
1941	97,090	108,836
1942	36,135	116,907
1943	63,510	149,957
1944	91,980	208,911
1945	113,515	184,273
1946	138,094	150,508

TABLE II

Imports by Countries
(Thousands of Barrels)

	1945	1946
Venezuela	63,825	78,381
Netherlands West Indies	36,456	42,833
Colombia	8,409	10,068
Mexico	3,579	6,062
Others	1,246	750
	113,515	138,094

TABLE III

Imports by Products
(Thousands of Barrels)

	1945	1946
Crude petroleum	74,127	89,110
Distillate fuel oil	4,754	5,138
Residual fuel oil	31,744	41,908
Other products	2,890	1,938
	113,515	138,094

TABLE IV

Exports by Products
(Thousands of Barrels)

	1945	1946
Crude	36,928	42,008
Motor Fuel	88,850	44,821
Kerosene	6,158	8,049
Distillate Fuel	33,827	29,495
Residual Fuel	11,919	9,521
Lubricating Oil	6,591	10,518
Other	....	6,096
	184,273	150,508

Gas Technology Short Course

A second annual short course in gas technology will be offered at Texas College of Arts and Industries, Kingsville, May 27-30. Procedure will be similar to last year when 200 men from ten states attended. Technical problems in transmission and utilization will be studied in two different sections.

Sinclair Signs Houdry License

Licensors during the war permitted the majority of units to be installed prior to signing formal license agreements. Houdry has just completed signing of license agreements covering all Fixed-Bed and TCC units in the world, with the execution of an agreement with Sinclair Refining Company. Shown at the formal signing are left to right (seated) R. F. Adams, Sinclair patent counsel; A. V. Danner, Houdry executive vice-president; and Curt Von Boetticher, Sinclair patent counsel. Standing: P. M. Quillert and G. A. Kessler, treasurer and patent counsel, respectively, for Houdry Process Corporation.

NEWMAN-MILLIKEN
GLANDLESS
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RALPH K. DAVIES, former director of the Petroleum Administration for War, and Robert L. Smith, executive vice president and general manager of the Los Angeles Daily News, have formed a new publishing company to operate on the Pacific Coast. The firm's first venture will be publication of Script, 18-year-old Pacific Coast magazine. Before the war Mr. Davies was a vice president of the Standard Oil Company of California.

WALTER BLUMENTHAL, manager of Raven Oil Co. Ltd., died suddenly on February 10. Mr. Blumenthal joined the staff of Manchester Oil Refinery, Ltd., in 1938 to manage the company's export department. He was appointed manager of Raven Oil when that company took over export activities of the Manchester group in 1944.

RICHARD ROLLINS, secretary and director of public relations of the Atlantic Refining Company, Philadelphia, has been appointed chairman of an industry special events sub-committee, Franklyn Waltman, acting chairman of the public relations operating committee, reported recently. The sub-committee will recommend special events having as their objective the demonstration of the progressive nature of the petroleum industry.

JOHN D. KELLEY of Anglo-Iranian Oil Co. recently retired after 26 years with the company and more than 22 years as editor of the "Naft," company magazine. Mr. Kelley was a teacher and writer in Canada before the first world war. He went to London in 1920 to write for the Financial News and joined Anglo-Iranian's publicity department a year later.

WALTER K. LINK, who has been head of the exploration division of International Petroleum Company in South America, has been transferred to New York as chief geologist of Standard Oil Co., (N.J.). He has been connected with companies of the Standard group for some 20 years, first in Colombia, later in the Far East and for ten years in the United States. In 1940 he made a study of several countries in Central and South America and since 1945 has been associated with International.

THE recent death of J. A. Grubb, regional manager of the Kansas and Northwestern territories of Black, Sivalls & Bryson, Inc., has brought about three changes in the administrative personnel, according to A. J. Smith, president. Ed. Nelson has been transferred from the propane system sales forces in Kansas City to Great Bend, Kansas, where he will direct the Kansas operations. Marion Miller, who has been Grubb's assistant in the Wichita sales office, will be in charge of that office. Lee Kelton will act as district manager in charge of the Connor tank division in Wyoming and Colorado.

Anglo-Iranian Chairman Visits U. S.

Sir William Fraser, chairman of Anglo-Iranian Oil Co., Ltd., and Col. H. E. Medlicott of the same company arrived in New York early in March for a visit of several weeks in the United States. Sir William Fraser was a speaker at the seventy-fifth anniversary meeting of th AIMME in Nw York.

Pennsylvania Grade Meeting

Annual meeting of the Pennsylvania Grade Crude Oil Association will be held June 5 and 6 at the William Penn Hotel, Pittsburgh, D. T. Ring, of Columbus, Ohio, association president, has announced.

International Power Show

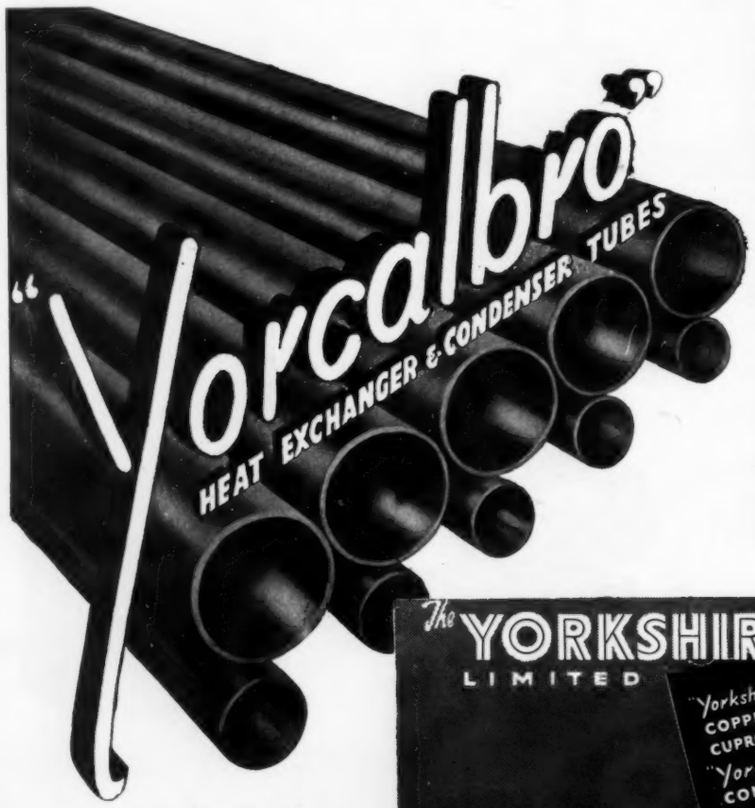
A complete exhibit of all types of power and equipment for earth-moving and construction was shown recently at the Melrose Park headquarters of International Harvester's industrial power division. The show as unusual in that 32 other manufacturers had machines on display in addition to International's complete line of crawler tractors, industrial wheel tractors, and diesel and gasoline engines. All of this equipment consisted of machines mounted on International crawler or wheel type tractors or self-powered equipment built by manufacturers using International power.

The giant TD-24, International's streamlined new diesel crawler tractor, was a focal point of the show. This largest and most powerful crawler tractor ever built is going into production at Melrose Park this year as part of the large line. The six cylinder TD-24 weighs 35,000 pounds. With eight speeds forward and eight in reverse, it is designed for high-speed handling of big loads.

The Melrose Park Works, built for bomber engines during the war, is the newest of the company's three works. The plant has 2,042,950 square feet of floor space for which International paid the government $13,750,000. The industrial power division which the plant houses was created in 1944. Two other division plants are at Milwaukee and Chicago.

Joins Hoover Firm

Rex W. Townsend, who has spent the past several years as a member of the Petroleum Division of the Department of State in Washington, has resigned from the government service to join the staff of the consulting firm of Hoover, Curtice and Ruby in New York.



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Cooperatives Plan International Expansion

(Continued from page 41)

finery at Phillipsburg in 1939, the nearby small oil pools were without pipe line service, and many producers were without a market. Immediately CCA plans were announced, however, other oil companies became interested in serving the pools with pipe lines. One company started a pipe line survey crew on a right-of-way to these pools within two days of the announcement. However, this type of opposition is credited by the promoters of CCA with having hastened its growth into the integrated company it is today, as when it could not buy oil it was forced to explore for it.

Although the oil companies today do business with the co-ops, selling or trading crude and products, as they do with any other commercial oil company, they are fully aware of the almost unbeatable competition which the co-ops provide on a steadily growing basis. This may hold even more true for the International Cooperative Petroleum Association, for the governments of countries controlling oil resources or consuming large quantities of products may welcome cooperative "non-profit" operations. The ICPA conceivably could offer greater inducements in taking out a concession. Cooperative distributors and refiners might be favored because domestic cooperatives were participants.

However, the oil companies and the co-ops find themselves allied on one of today's major issues —nationalization of oil by governments. The co-ops are opposed to it as strongly as are the commercial oil companies. The executives of major oil companies know that tremendous changes are impending and they know that cooperatives are going to have an important role in the developing pattern of oil commerce," Cowden states. "Actually they have less to fear from cooperatives in any country than they have from complete nationalization, in my opinion."

A case in point is Sweden. When the Swedish cooperatives began trading in oil, the commercial oil companies did not oppose them but actually lowered prices voluntarily. At that time there was great concern that the socialist government of Sweden might nationalize the oil business. The cooperatives, who were opposed to nationalization, demonstrated that cooperative marketing could bring about the same results, from the government viewpoint, as nationalization but without its attendant evils. Nationalization plans were dropped, and the oil companies continued to do business alongside the cooperatives. Although the possibility of nationalization may not have been permanently averted, yet the cooperatives proved their ability to fight it effectively.

This also demonstrates that cooperative success is due not only to the financial savings it offers its members, but because its social philosophy appeals to large numbers of people. This is an important factor which should not be underestimated in these maladjusted postwar years when all kinds of ideologies are fighting for dominance.

Cooperation is not communism or socialism. It is defined by Cowden as "a rational, share-giving form of enterprise needed especially in these times when the concentration of wealth is dispossessing and casting adrift many people. It offers them a chance, in cooperation with their fellows, to regain title to the material things that minister to life and health. It enables them to play a larger game than they can play as individuals. It is something around which they can organize their lives. It is recognition that wealth is produced, in the last analysis, not by individuals but by fellowship."

One will seldom find an American farmer who is a communist or a socialist, but in the United States alone there are almost two million farmers who are cooperators. They have extended their farming from the topsoil to the subsoil, and as of this year with the launching of the International Cooperative Petroleum Association there aren't any fence limits on the subsoil farming they have in mind.

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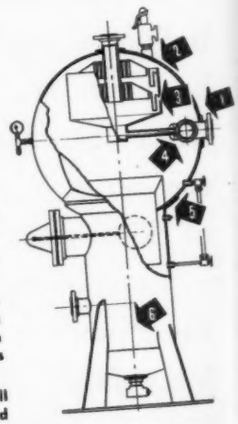

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